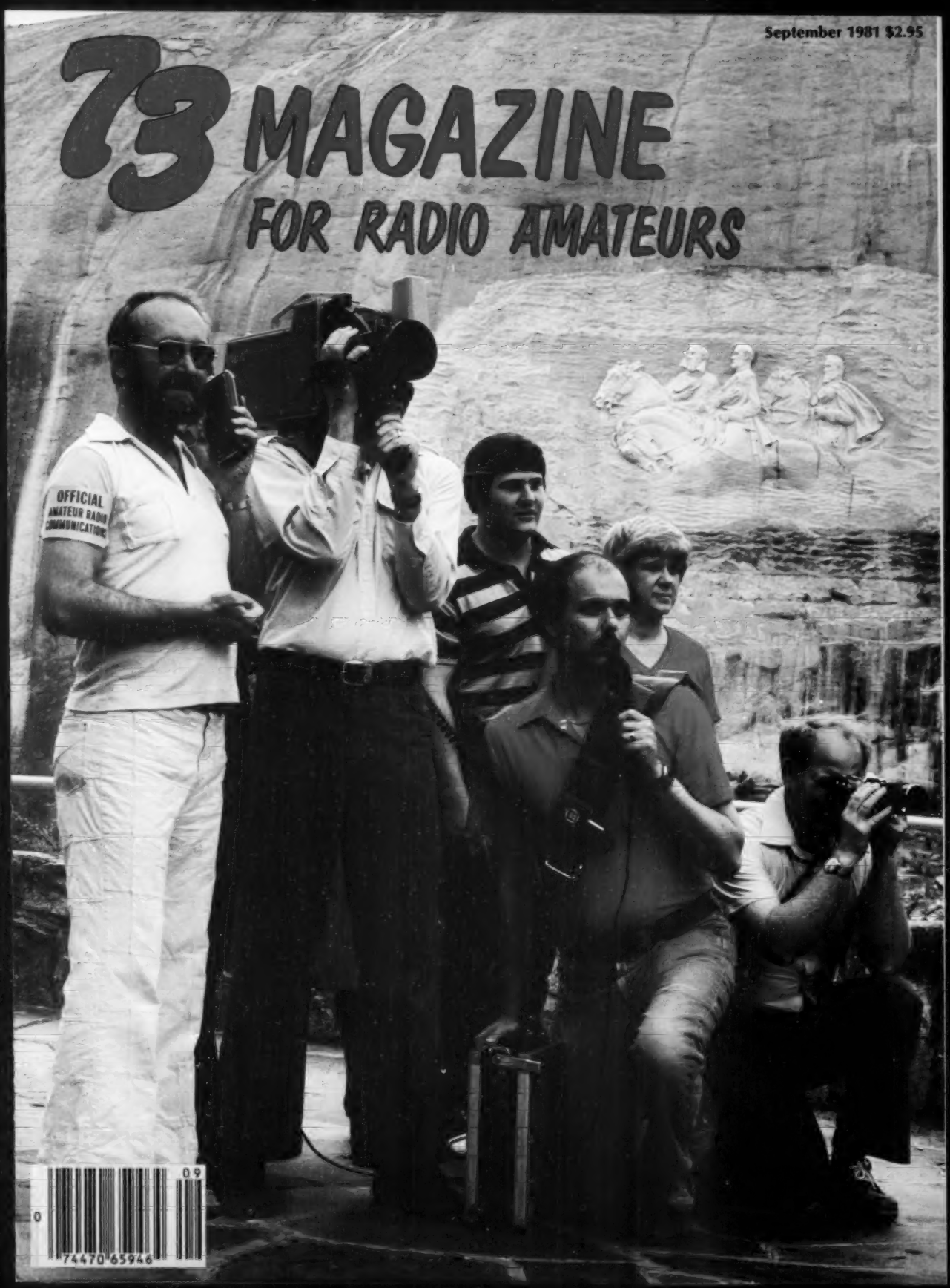
September 1981 $2.95

73 MAGAZINE

FOR RADIO AMATEURS



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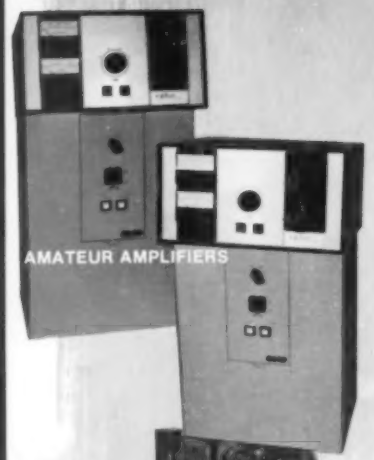

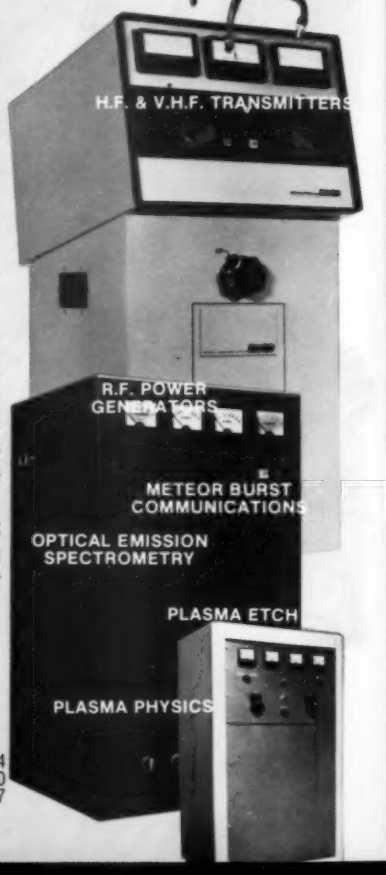

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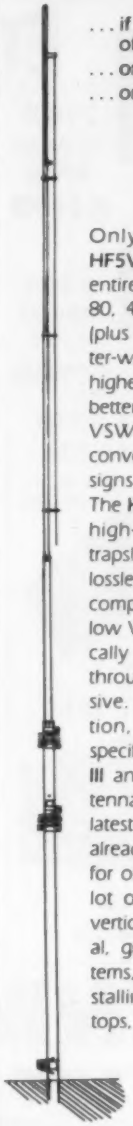

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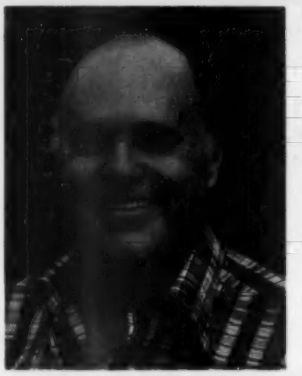
W2NSD/1
NEVER SAY DIE

editorial by Wayne Green



CONSUMER PROTECTION

A flyer being passed out at some Chicago area hamfests is a case where it is not always the customer who is right. In point of fact, I've found that in a surprising percentage of the complaints I've received, it has been the ham who has been the real troublemaker. In this case, we have a flyer, unsigned, but allegedly being perpetrated by K9SOA. The flyer is based upon distortions and innuendo.

I talked with a dealer recently who ran through some of his recent battles with hams. One brought in his rig to be fixed. He was given an estimate of the cost of repairs. The rig was repaired and the bill was close to the estimate. The chap then beefed about how much it cost and asked for something which took the salesman out of the room. The ham grabbed the rig and ran out of the door with it, refusing to pay anything. It took a judge to make him pay up.

Another customer brought in a rig with intermittent output. With final transistors at $85 a clip, he was aware that the bill could be heavy. The serviceman (ham) tried a new final, but that didn't do it. Then he switched the final board with a brand new one. Still no go. Next he tried a brand new master board. That fixed it. Upon checking the faulty board, he found that a coil was causing a short when it heated up...so he fixed that. Rather than taking another hour and running up the repair costs even more, he left in the brand new boards.

The ham came in for his rig while the repairman was out. He asked for the bum part. The salesman went to the repair bench, spotted the final transistor, and gave it to the customer. When the repairman came in and discovered the $85 transistor missing, he had the store owner get in touch with the ham and ask for it back. The ham insisted that the transistor had his call engraved on it and that it was from his rig. The owner explained the whole situation and that the part had the date on it of manufacture, which was quite recent. The ham told the store owner where he could stick it and hung up. The call of this ham had an FAO in it, I understand. Is it any wonder that more and more ham dealers are giving up on even trying to make repairs? They find the customers making every effort to screw them...the repair techs are making so much that often the dealer has to swallow part of the repair costs, and so it goes.

Oh, there are sharks out there among the manufacturers and dealers, too, but very few...and I generally hear about them as soon as they start causing trouble. I've been able to put a lot of these turkeys out of business.

One recent rip-off ended with the ham pulling the stunt being convicted. This is not the first time for him. Knowing his history, I have never accepted ads from him. The first time, he got a lot of *QST* readers through his ads in that magazine. This last trip he stung quite a number of *Ham Trader* readers.

This was the same chap who appeared at Dayton in 1980 and was selling memberships in a national amateur radio organization out of a booth there. I was in Europe at the time, so I didn't hear about it until I arrived in Wiesbaden to give a talk at a hamfest and met a chap who had been to Dayton the previous week. I was suspicious immediately. How can any group even think of trying to start a national organization without at least talking with me? They can't get anywhere without a publication...and *HR* is totally tied up by the ARRL, which doesn't leave a lot.

When I got back, I looked into it and lo, there was our ham from the *QST* rip-off fame, now in Connecticut. His pitch was that a group of ten wealthy hams had gotten together to form a national ham group, each putting up $15,000 in seed money. I knew that had to be hogwash. That wasn't likely to happen without me hearing about it. I wrote about the scam in *73* and did not get sued, further confirming it as a caper. The ham quickly left Connecticut and reopened in Virginia, where the *Ham Trader* rip-off came from. Well, he's been convicted...again...so let's see what is next.

Even prison doesn't stop the truly dedicated bunco artists. In the computer field, we have a chap who ran two rip-offs and was convicted and sent to prison for both of them. The first time he crawled under the fence and escaped, only to turn up in Tulsa a few months later with another way to cream computer hobbyists willing to believe they could get something for almost nothing. This chap turned up a third time recently, this time operating from prison with the help of a guard. There's no stopping a truly dedicated man.

ETHICS

Yes, surprisingly enough, an ethical question has been causing some storms in DX clubs. The question raised is this: How much is it ethical to charge a fellow club member for the date and time you worked a rare station using his call?

Sure, there was a time when

W2NSD/1 ON-THE-AIR SCHEDULE SEPTEMBER, 1981

1	20-40 CW
8	15-20 Phone
15	20 RTTY
22	15-20 Phone
29	15-20 Phone

Response to our 15- and 20-meter phone sessions has been especially strong, so we have scheduled additional time on these two bands. On both phone and CW nights, look for us in the first 25 kHz of the General portion of each band. We'll be on the higher frequency band first, starting at 7:00 pm eastern time.

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Amateur radio's innovation capabilities are enviable. It is time that we donned our collective thinking cap and began to produce some workable systems at reasonable costs. This not only will get us in on the satellite TV fun, but, more importantly, will sharpen our skills for use in the neglected areas in which much of ham radio's future lies—the microwave region and worldwide communications via satellites.

We are interested in complete systems, in individual components (receivers, low-noise amplifiers, etc.), antennas and antenna mounts, and everything it takes to produce an operational system. So, get writing! If you have any questions, get in touch with us. And don't forget: *73* pays on acceptance—you can build or improve your TVRO station at our expense.

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A compact transceiver with FM/SSB/CW plus...

TR-9000

The exciting TR-9000 2-meter all-mode transceiver combines the convenience of FM with long-distance SSB and CW in a very compact, affordable package, ideal for mobile installation. With its fixed-station accessories it becomes the obvious choice for your ham shack.

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  All the popular 2-meter modes.
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  Covers all 2-meter Amateur frequencies as well as MARS and CAP frequencies (simplex and any repeater split) between 143.9000 and 148.9999 MHz.
- **Digital dual VFOs**
  With selectable tuning steps of 100 Hz, 5 kHz, and 10 kHz, convenient for each mode of operation.
- **Digital frequency display**
  Five, four, or three digits, depending on selected tuning step.
- **Scan of entire band**
  Automatic busy stop and free scan.
- **Five memories**
  M1-M4...for simplex or ±600 kHz repeater offset. M5...for nonstandard offset (memorizes transmit and receive frequency independently).
- **SSB/CW search**
  Sweeps between 0 and 9.9 kHz around the selected frequency in 100-Hz steps, while the main knob selects in 10-kHz steps. Easy way to find SSB or CW activity.
- **UP/DOWN microphone**
  "Beep" sounds with each frequency step. (Supplied with TR-9000.)
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  Suppresses pulse-type noise on SSB and CW.
- **Improved receiver front-end characteristics**
  Low-noise, dual-gate MOSFET and two-stage monolithic crystal filter.
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  Receiver incremental tuning, to tune only the receiver slightly off frequency in the SSB/CW mode. Functions on memory, also.
- **RF gain control**
  Threshold-type control, permitting accurate S-meter readings on SSB/CW and FM modes.
- **CW sidetone**
  Enables monitoring of keying during CW operation.
- **Automatic AGC selection**
  AGC time constant selected automatically with MODE switch (slow for SSB and fast for CW).
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  10 watts/1 watt RF output on FM/CW. Always 10 watts on SSB. Improved power module for reliable and stable linear RF output.
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  VFO A/B, RIT, ON AIR, and BUSY.
- **Rear-panel accessory terminals**
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  Only 6-11/16 inches wide by 2-21/32 inches high by 9-7/32 inches deep.
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- PS-20 power supply
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something like that was done for pure friendship, but leave it to some hams to get commercial about their hobby. For many years we've seen some of the DX clubs swapping lists of needed countries..."Hey, if you hear an XZ on, work him for me, okay?" So the big signal corps often gets in there and whips off a dozen or so contacts, making sure that friends and club members have the new country nailed down.

Ten dollars for the date, time, and frequency-of-your-choice contact seemed reasonable for quite a while, but now inflation has hit and friendships are being debased with demands for more cash. $20 is a more acceptable "gift" for a new one, with some rumors of $50 being asked. What is amateur radio coming to? I think that anything over $25 is outrageous.

MENTAL INCOMPETENCE

With the recent court decision to deny K6EOA his license on the basis of mental incompetence, many feel that things may have gone too far. Indeed, it has been reported that amateurs in southern California are in a panic, with many barricaded in their homes against a possible FCC onslaught.

Much of the mail in the last few weeks has expressed legitimate concern over this situation, bringing up again that old and unanswered question: Which comes first? Amateurs want to know whether normal people lose their sanity when they get ham licenses...or whether licenses are only issued to mental cases. It has apparently leaked out that amateurs must travel in pairs to get two oars in the water.

Frankly, I think this is a tempest in a teapot. I say that before judges rule on *our* sanity, someone should rule on *theirs*...and we would be in a standoff immediately. Remember that most judges started out as lawyers. I rest my case.

MORE RADAR NEWS

Hardly a week goes by without some reader calling up to say that he's been nabbed for speeding...and what should he do. In all of these cases the ham was transmitting as he went through a radar speed unit and the ticketed readers feel that

Continued on page 133

Well...I Can Dream, Can't I? **by Bandel Linn K4PP**

I found the trouble! I had to rip out quite a few parts but—lucky for you—I'm only charging you three dollars for the whole ball of wax!

The Rig That Filters The Crowd

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Optional filters include 1.8 kHz 8-pole crystal ladder ssb filter, 500 Hz 8-pole cw filter, and 250 Hz 6-pole cw filter.

Front panel switches put any optional filter in series with the standard filter for up to ***16 poles of filtering*** for near ultimate skirt selectivity.

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Optimized sensitivity and dynamic range. The OMNI sensitivity range of 0.3 μV typical (slightly less on 160 & 80M) combines with a 90 dB dynamic range to provide an ideal balance that will handle any situation from copying a weak signal half way 'round the world to keeping the next-door kilowatt from muscling in. And a PIN diode switched 18 dB attenuator is included for extra insurance against overload.

More crowd-handling features—and all standard equipment.

Built-in notch filter. To drop out unwanted signals or carriers. Tunable from 200 Hz to 3.5 kHz, with a 50 dB notch depth.

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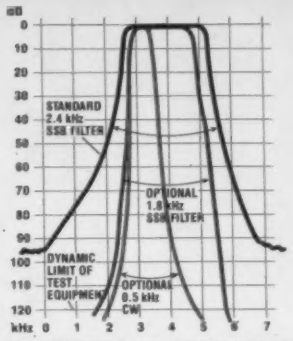
Built-in noise blanker for those times when your noise-generating neighbor is crowding your receiver. Filtered to handle the big signals easily.

2-speed break-in. When QRM or QRN is heavy, switch to "Slow." Use "Fast" for instant, full break-in for enjoyable rag-chews or stalking DX.

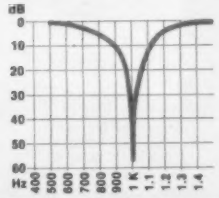
OMNI-C features stand out in any crowd.

All solid-state—from the pioneer, Ten-Tec.



OMNI/SERIES C I-F RESPONSES WITH STANDARD AND OPTIONAL FILTERS.

TEN-TEC OMNI-C



NOTCH FILTER PERFORMANCE ADJUSTED TO 1 kHz POINT.

All 9 hf bands—only crystals are needed for 18 and 24.5 MHz bands.

Broadband design for instant band change without tune-up or danger of damage to the final amplifier. Another Ten-Tec *original.*

"Hang" AGC for smoother action.

WWV reception on the 10 MHz band.

Digital readout in two colors, red for the 5 significant places, green for the 6th digit (100 Hz). Instant recognition.

Separate receiving antenna capability. Switch receiver to a common antenna for transceive or separate receive-only antenna; the system also acts as receiving antenna by-pass with an instant break-in linear amplifier or transverter.

"S"/SWR meter, electronically switched.

200 watts input, all bands, with 50-ohm load. 5 year pro-rata warranty.

100% duty cycle on all bands up to 20 minutes. Full RTTY and SSTV power.

Built-in VOX and PTT with front panel controls.

Built-in phone patch jacks for easy interface.

Built-in zero-beat switch for spotting the exact frequency of a DX station.

Built-in adjustable sidetone volume and pitch.

Adjustable threshold ALC, optimum power for driving a linear. Provides means of working into a high SWR.

Front panel control of linear or antenna. The rear panel bandswitch terminals control relays or circuits in step with front panel bandswitch.

Automatic sideband selection plus reverse.

Low distortion audio, less than 2%; a Ten-Tec trademark.

Clean signal, exceeding FCC requirements.

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Model 546 OMNI-C transceiver $1289

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Food for thought.

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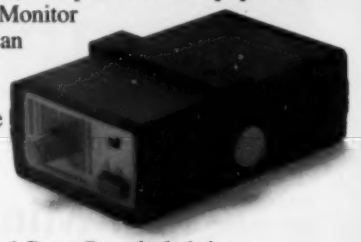

- All tones in Group A and Group B are included.
- Output level flat to within 1.5db over entire range selected.
- Separate level adjust pots and output connections for each tone Group.
- Immune to RF
- Powered by 6-30vdc, unregulated at 8 ma.
- Low impedance, low distortion, adjustable sinewave output, 5v peak-to-peak.
- Instant start-up.
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Group A

67.0 XZ	91.5 ZZ	118.8 2B	156.7 5A
71.9 XA	94.8 ZA	123.0 3Z	162.2 5B
74.4 WA	97.4 ZB	127.3 3A	167.9 6Z
77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
88.5 YB	114.8 2A	151.4 5Z	203.5 M1

- Frequency accuracy, ± .1 Hz maximum - 40°C to + 85°C
- Frequencies to 250 Hz available on special order
- Continuous tone

Group B

TEST-TONES:	TOUCH-TONES:	BURST TONES:
600	697 1209	1600 1850 2150 2400
1000	770 1336	1650 1900 2200 2450
1500	852 1477	1700 1950 2250 2500
2175	941 1633	1750 2000 2300 2550
2805		1800 2100 2350

- Frequency accuracy, ± 1 Hz maximum - 40°C to + 85°C
- Tone length approximately 300 ms. May be lengthened, shortened or eliminated by changing value of resistor

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10,000 Contacts from Easter Island

—four Minnesotans make a dream come true

Easter Island, Isla De Pascua in Spanish, is positioned 2,500 miles west of Santiago, Chile, in the South Pacific, one of the most remote inhabited islands in the world. The island is substantially triangular in shape, 13 miles in length by four miles wide, and has three inactive volcanic formations.

The soil of the island is primarily of red volcanic dust which constantly found its way into the equipment, clothing, and the skin of the operators. The island is accessible either by twice-weekly air service or by ship which sails one or two times a year.

Easter Island is governed by Chile and is assigned the call prefix CEØ. The island has not been active on the air for the past two years—from May, 1979, to February, 1981—as the station of Father Dave, priest of the Catholic Parish Parroquia, had been out of operation due to a storm in May of 1979.

Easter Island is noted for the Moai religious carvings which are positioned on the island, with numerous theories behind the some 600 statues as to who carved and erected them.

Steve Boller NØNO of Lake Minnetonka, Minnesota, and George Boller KØDHI (NØNO's father), Dick Linder WØRIF of Winona, Minnesota, and I operated the Easter Island DX-pedition from February 17 to 24, 1981.

A group photo while sightseeing in the cave area. We are standing in front of Moai that face toward the town. From left to right, Hugh K4ESQ, Dick WØRIF, Father Dave CEØAE, George KØDHI (Steve's father), and Steve NØNO.

Thanks

While most articles give the "thanks" at the end of the article, it is particularly noted that this DXpedition would not have been possible but for the help of the following:

Burghardt Radio provided transceivers and accessories with expert follow-up advice on equipment repair while we were on Easter Island. It was discovered that one of the transceivers developed a receiver problem during operation and no courtesies are extended to the manufacturers of the transceivers who were very reluctant to assist in this DXpedition.

Butternut Electronics supplied their HF5V-III vertical, which performed perfectly and was an ideal antenna to transport as check-on baggage. Heathkit provided an SB-200 linear amplifier on loan, which worked marvelously. Sid Kitrell WØLYM at Telex/Hy-Gain assisted with a TH3 Mark II triband beam. Hiawatha Electronics of Winona furnished coaxial cable at cost. Lan-Chile Airlines and Braniff Airlines transported the four operators and all of the associated equipment including the triband beam, as discussed later, from Minneapolis to Easter Island by way of Santiago.

Patricio Fernandez, CE3GN, of Radio Club de Chile, assisted with the licensing procedures through the Secretaria de Telecommunications of Chile who graciously issued each operator an individual license. It is interesting to note that the Chilean licenses are considered a work of art, contrary to the computer-generated licenses issued by the Federal Communications Commission in the United States.

Finally, and most important, thanks goes to Father Dave CEØAE, whose accommodations for the operators and assistance with the many other important facets of this operation are deeply appreciated.

Preparation

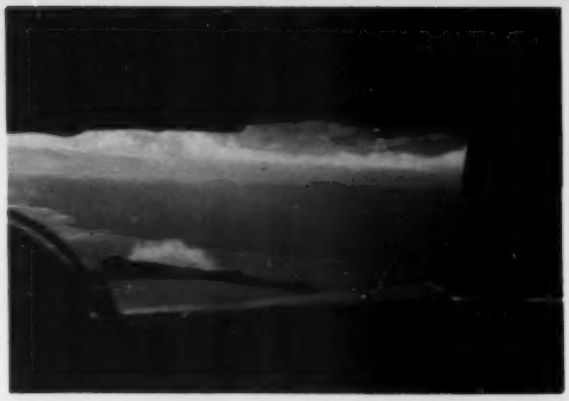
The first objective for a DXpedition is to determine the location, feasibility of operation, transportation, availability of power, lodging, food, and licensing for operation. Fortunately, Easter Island provided a superior location in the South Pacific during the middle of their summer, which was during the middle of the cold Minnesota winter, thus providing a major incentive for the operators.

Easter Island is accessible by transportation on Lan-Chile which flies two flights a week out to the island, using Boeing 707s. The island provides essentials of dependable electrical service and adequate housing facilities which made for an enjoyable trip and encouraged over 10,000 contacts in less than a week's time. The government of Chile granted reciprocal licensing to US amateurs with the assistance of the Radio Club de Chile.

Once the location of the DXpedition had been chosen and licensing procedures instituted by executing the documentation and forwarding the documents to the Radio Club de Chile, preparation of airline reservations was undertaken, along with the securing of equipment for operation. The airline reservations were particularly important because of the fact that there are only the two flights a week to the island, so, consequently, extra time was allowed for incoming and outgoing flights to prevent any scheduling problems.

The planning for the DXpedition began in September and was seriously undertaken in December, including the licensing procedures. Numerous discussions were conducted over "DX juice" (pitchers of beer), laying the groundwork for the operation and drafting lists for operating equipment and supplies. During these discussions, it was decided that two stations would be utilized, that the stations would be identical for interchangeability in the event of equipment failure, and that each group traveling to Easter Island would carry an operational station. Each group could operate independently of the other in case of separation of the parties and if only one party made it to the island.

In late December, with the licensing underway and airline reservations con-



Flying in on approach to Easter Island. This shot was taken by Steve NØNO from the cockpit of the Boeing 707.

Take-List for Easter Island DXpedition

- FL-200 coax input single wire relay
- SB-200
- Transceivers (2) w/filters
- Pwr supplies (2)
- Memory keyer
- Standby keyer
- Microphones (2)
- Paddles
- Logs
- SB-200 spares
- Small speakers
- 2 Verticals
- Beam
- Dipole wire for 40 and 80
- Coax—300' RG-8X
- Radials
- Fishline
- Assorted coax connectors, male and female
- Swr bridge
- Nylon cord for beam
- Beam mount
- Insulators for dipoles
- T-connectors
- 20,15,10m stubs
- Soldering iron and solder
- 220-110-volt stepdown trans
- Extension cords
- Lights (7½ Watt)
- Miscellaneous wire goods
- VOM
- Wire nuts
- Screwdrivers—regular and philips
- Diagonal cutters
- Needle nose pliers
- Pencils
- Tape—black plastic and cloth
- #14 wire and connectors
- Fuses
- Fans
- Crescent wrenches
- Vise grips
- Travel Plugs
- Flashlight
- Strapping tape (fiber)
- Hose clamps
- Foot switch
- Scrap paper
- Swiss army knife
- Spare SB-200 tubes
- Ground radials
- Aspirin
- Band-Aids™
- Thermometer
- Motion-sickness pills
- Gum

I had to go up on top of Father Dave's church to do antenna repairs for Father Dave in order to place his station back in operation. The church roof was rather rusted, so one always had to watch where he stepped.

firmed, contact was made with manufacturers and suppliers regarding any sponsorship and assistance for the DXpedition. It was noted that all of the manufacturers and suppliers were willing to cooperate by providing equipment at the lowest possible cost or on loan, which was graciously accepted.

All of the manufacturers and suppliers previously thanked were very cooperative in the spirit and brotherhood of amateur radio, with the exception of the manufacturer of transceivers who unfortunately not only did not reply to our requests but when contacted by telephone had a lack-of-candor problem in acknowledging assistance. This would not have upset the DXpedition as much except that the equipment suffered operational problems on Easter Island. As many an amateur can realize, there is no local radio store or supply house down the street to run to pick up a replacement i-f transformer for the receiver, or other parts.

Spare parts were taken along, but working on solid-state equipment in the middle of a remote island is not the most ideal situation, especially lacking the sophisticated testing equipment required. In spite of all this, repairs were made to a receiver i-f transformer by removing the opened transformer and using a capacitor as a substitute, although this resulted in reduced receiver sensitivity.

When the receiver problem was recognized in the middle of the week of operation, stateside amateurs in Ohio and California assisted by telephoning Jim Smith WBØMJY of Burghardt, who came up on frequency on 15m to diagnose the problem. Burghardt immediately identified the problem after being informed of the symptoms and instructed in disassembly of the transceiver to reach the opened transformer.

Disassembling a foreign-made transceiver to reach a circuit board below another circuit board can be a jigsaw puzzle on first-time disassembly. Burghardt advised on disassembly and stood by on frequency for advice on successful repairs. The operation continued for the week with little downtime.

Most important to the DXpedition after securing the licenses and equipment was drafting lists and dividing equipment prior to departure for equal weight distribution as well as independent operation of stations. The individuals traveled in groups of two and divided all equipment, including antennas, *prior* to departure to avoid any last-minute preparations.

The DXpedition was publicized in *The DX Bulletin*, the *Long Island DX Bulletin*, Geoff Watt's, and other DX bulletins as well as foreign publications, advising of operation and QSL procedures. This was undertaken a month prior to departure.

Final Travel Arrangements

While it is not an absolutely mandatory requirement, every DXpedition should have an airline pilot who knows his way around airlines. Our airline captain, Steve NØNO, prepared preliminary letters of introduction on company letterhead, not only in English, but also in the foreign language needed, which in our case was Spanish, just in case the letter was required for customs or for airline identification. The letters we had proved to be invaluable, especially the Spanish letters, when Lan-Chile was waiting for lost luggage to arrive from the Minneapolis airline.

Our travel arrangements were further expedited and secured by Steve, who was instrumental in obtaining transportation for the 12-foot-long beam package and masting from Minneapolis to Santiago and Easter Island, as well as meeting the other operators on arrival at customs in Santiago, where a Chilean customs pass allowed access and movement through the customs area. Finally, Steve coordinated the arrangements with Lan-Chile, who were most hospitable and accommodating to the DXpedition.

Travel

The two groups departed a couple of days before leaving for Easter Island on separate flights when Steve NØNO and his father George KØDHI left for Santiago from Minneapolis by way of Dallas, New York, Buenos Aires, and Santiago. Dick WØRIF and I departed the following day on a Minneapolis-based carrier to Miami, where that carrier managed to misplace the vertical antenna at the change-over in Chicago. This required numerous phone calls after arrival in Miami to not only track down the antenna but to expedite its shipment to Miami for departure on the Miami-Santiago flight of Lan-Chile.

Due to the short time between flights, it was necessary to secure the antenna in Miami, as otherwise the antenna undoubtedly would not have followed the group to Easter Island, making operation rather

difficult with only a beam and wire antennas. Fortunately, Lan-Chile was most cooperative in securing the antenna from a third carrier, Eastern Airlines, which transported it from Chicago to Lan-Chile in Miami.

It was found that the Lan-Chile personnel understood the urgency of the matter by reading the Spanish letter prepared by Steve on his airline stationery and made a special effort to locate and secure the antenna prior to our departure for Santiago. WØRIF and I proceeded to Santiago via Lima, Peru, with an extra long stopover due to the hydraulic failure in the DC-10. On our arrival at Santiago, NØNO was at the airport to assist in going through Chilean customs.

Going through customs is interesting, especially when one is carrying brand-new communications equipment through a country where possession of such equipment is a sensitive matter due to prior political considerations. It always helps to have someone in the group speak the language of the country and, fortunately, three of the operators were fluent in Spanish, although it was interesting to observe that the customs individual didn't want to discuss the matter in Spanish but preferred to discuss it in English. After the mission and purpose were explained to customs and the documented paper work, including licenses, was shown, the operators were waved through customs with only a cursory inspection. However, we learned that it is best not to show any papers or documents unless requested, to avoid prolonged questions and delays.

Layover

After spending over a day in the air between Minneapolis and Santiago and transferring through airports with the weight of the equipment, which was all carried on as hand luggage to avoid its being lost, let alone being banged around by the "baggage monkeys," everyone was ready for a good meal, hot shower, and a good night's rest before departing for the operation point at Easter Island. It also gave everyone a chance to have a final checkout of procedures and make final arrangements with the airline, Lan-Chile, for the five-hour flight to Easter Island.

After breakfast the next morning, we discovered on our trip out to the airport that our flight was to be delayed six hours, to late afternoon, so everyone decided to return to Santiago for more sightseeing. The tour was held by the senior member of our crew, George KØDHI, who had previously been to Santiago. Later, everyone returned to the airport for the afternoon departure on Lan-Chile. Fortunately, Steve had arranged to leave all of our baggage at his airline operations office, eliminating the need to carry the equipment between the airport and the hotel, let alone worrying about security of the equipment.

On boarding, Lan-Chile was most gracious in serving DX juice to the group to motivate our operational spirits and provide in-flight briefings in the cockpit by the Lan-Chile captain to our captain. The five-hour flight was rather uneventful, very enjoyable, and provided for interesting discussion up in the wheelhouse due to the professional courtesy of one airline captain to another captain. Thus, NØNO had the first view of Easter Island.

Arrival

The biggest asset to the DXpedition was that, by coincidence, the local amateur on Easter Island was also the priest of the only church on the island and a very highly regarded individual. Father Dave CEØAE, with his Jeep, awaited our arrival at the airport, dressed in his DX hat, T-shirt, shorts, and work boots. He had arranged accommodations for the group and assisted with the transferring of luggage (numerous trips) between the airport and the residence where we were to stay. Situated on an upper portion of the island, the residence afforded a beautiful view of the South Pacific. Father Dave had made arrangements for our group to have three rooms: two for operating and one for sleeping. This plan made operations on a twenty-four-hour basis possible.

These Moai statues on the hillside were carved and left standing before having been moved to the other side of the island. Many were still buried under the ground and some may have been washed out to sea.

The first introduction to the house, which I am sure by Pasquinian standards is upper middle class, was rather surprising to all of the operators. Fortunately, the majority of the homes have running water, electricity, and the infamous flushable toilets, and the climate is such that one can stay very comfortable both day and night.

Our first requirement was electricity for the rigs. Besides using a three-prong 220-volt plug which looked like a socket out of a 1920 radio set, it was noted that our house was wired with lamp cord, which obviously would have caused problems for our linear. After discussion on what to do, the decision was made to take one of the heavy-duty extension cords, cut off the plug, and wire directly into the knife switch of the 220-volt fuse box. The box was interestingly constructed, with fuses which looked to be something out of the 1920 era of ceramic fuses. The whole thing had obviously seen much use, and our questions as to the electrical system were many. Our fears proved to be true the following morning when the fuses blew and, as seems to be the custom on the island, one places a number of strands of lamp cord wire across the fuse instead of replacing it!

As a goodwill gesture to our host family, the group compensated them for all electricity used during the week, which also included *their* electricity. The total bill turned out to be about $40, or $10 per person for the week, certainly not unreasonable, considering that the electric power on the island is generated by

Everywhere Father Dave's Jeep went, a cloud of volcanic dust followed. This cloud eventually covered all of us with the red powder.

diesel-electric equipment with four generators, two running and two on standby. All of the fuel is brought in by ship once or twice a year and therefore the cost is much higher than elsewhere.

As a matter of fact, a majority of everything is brought in by ship. If you have ever thought that a can of Coke is expensive out of a machine, wait until you have to pay $2 for a can of Coke on Easter Island. You can't appreciate the real convenience of those 35-cent or 40-cent machines nowadays until you've bought a can on Easter Island.

Now back to the electrical system. It was jerry-rigged and served the group well when we ran an extension cord directly from the knife switch of the fuse box into the operation shack. We soon found that extension cords were invaluable pieces of equipment, as were multi-socket switch-boxes, both of which we should have brought more of. Also, small step-down transformers of 220-110 were invaluable for powering extra cooling fans on the linears, soldering irons, and other accessories.

Operations

The transceivers were easily put into operation with the vertical antenna going up first and the tri-band beam following the next morning due to the late arrival of the plane at the island and rainfall that night. Numerous contacts were made the first evening with the Butternut five-band vertical, including our pipeline back to the Twin Cities. We had almost a daily schedule with Joe KBØCO, who operates from the notorious radio hill in Minnetonka and provided assistance and attended to some of the errands.

Included on page 1 of the logs are the calls of the Twin City DX Association, whose meeting adjourned just in time to get in on the opening volleys from CEØA. Numerous other amateurs provided phone patches to the members of the operators' families, including my patch home to Delaware at no cost, which we are so grateful for. Our other needs, such as getting Burghardt on the air the morning when we discovered we had receiver problems, also were attended to. Burghardt was able to remedy the situation in the field with the components which we had on hand, subsequently ensuring continuous operation of the stations.

We operated almost around the clock, usually stopping at 2 or 3 in the morning and then starting up early in the morning on 80 and 40 meters. The JA runs on 80 were a lot of fun, to say nothing of working the boys back home. Prior to departing home, Stig LA7JO called NØNO on the landline to arrange some 80-meter schedules. What a surprise it was when he talked for 15 minutes, at long-distance rates, just to get zone 12 on 80 meters. For two or three nights 80 meters was salvoed by S7 static and we thought we would never get in touch with Europe. We finally hooked up late one evening and made about 40 European QSOs before the sun rose there.

We operated contest-style for the most part and ended up with 10,000+ QSOs for the one-week operation. That's an average of one per minute, which includes sleeping time thrown in. We usually had two kWs in operation simultaneously and were saved from crossband interference by 1/4-wave stub traps which were connected to the output of the kWs with a T-connector. Without them the crossband interference was intolerable. That is a handy idea for Field Day operations.

All in all, most operators were courteous—with the usual exceptions. Our pet peeve was ops who would consistently, time after time, call out of turn when we had to resort to working call areas. There weren't many, but we feel that the "phantom" logger jotted their calls down in the list of bad guys. Maybe lists aren't that bad after all.

We also could not have existed without our outboard vfo's. We felt sorry for those who were unable to work split from the home front, but then again there probably weren't too many at home who felt sorry that we had spent mega-bucks to put Easter Island on the air. In other words, if you're really going to be serious about DX, buy yourself an external vfo.

In the dark of one of the evenings, one of the operators, in trying to rotate the antenna, thought he had the rotating line and just couldn't understand why the beam wasn't rotating—until he discovered that he had one of the guy lines and was trying to rotate the whole beam with the guy wire.

Credit has to be given to Hy-Gain for constructing a beam which performed very well under the conditions of erection as well as operation and rotation. Special thanks go to Sid Kitrell for assisting us with arrangements on the Telex/Hy-Gain beam.

Operation was smooth, and the operators had time to assist Father Dave in placing his station back on the air. I ended up on the roof of the church working on the vertical antenna, which gave me the opportunity to experience religion above the church as well as in the church. Father Dave's station was placed in operation within days after our arrival on Easter Island, and it is now being operated on a daily basis, time permitting, due to all of his other church duties on the island. While we were operating, Father Dave was sometimes able to stop in at the shack and do some operating himself, although being the only priest on the island places many demands on his time.

It is a custom on the island that blessings can be obtained from the church for such things as the tourist buses, the landing craft used to bring goods in the yearly visits by the ship to the island, fishing boats, and any other things for which the Pasquinians may want to receive blessings. It is interesting to note that

The picture above shows the operating home, which is in the upper portion of the village, the Butternut vertical, and the Telex/Hy-Gain beam. The road is made of red volcanic dust; the vegetation just grows wild. The small shack behind the large home houses a family of three.

Father Dave operating the station with the Kenwood TS-130S and Heath amp. Note cooling fan.

while we were there a fishing boat was blessed. The boat was blessed independently of the motor, which then was also blessed.

We sometimes thought that if we had observed proper customs and had had each piece of our equipment blessed, we may not have experienced some of the transceiver problems we encountered. We therefore concluded that it is very important to observe the local customs on the island and advise all others proceeding to Easter Island that they might want to undertake the blessings of the church on their equipment before beginning operation.

Father Dave took time to spend free moments with the operators individually, which was a rewarding experience for each of us, and he also spent time with us as a group, which included swimming at the beach, picnicking, and a very extensive tour and discussion of the past history of Easter Island. For a priest, Father Dave drove a four-wheel vehicle better than most people. He had no qualms about cutting through the ruts in the road and endured the red volcanic dust which permeated our nostrils and vocal cords, in addition to turning everyone a very particulated red color —that of volcanic dust. By the time of our departure, the operators, equipment, clothing, and baggage were all thoroughly saturated with volcanic dust.

One of the lighter moments of the trip occurred one evening when an operator came wild-eyed into the bedroom where another operator was sleeping. He had a panic-stricken look on his face, scanned the room with a flashlight, and in sheer terror pushed a stone up against the door. When questioned by the now-awakened operator as to what the hell was going on, he excitedly announced that he had seen a rat. I surmise that that operator may have had too much DX juice, which was strictly for medicinal purposes and for putting one into the proper frame of mind to secure the DX contacts. But the operator still swears to this day that the animal he saw was a rat.

It is possible that it may have been a little cockroach or a salamander, but if he says it is a rat, we'll let you decide for yourself. Later on in the evening when the "rats" were running through the ceiling, another operator banged on the ceiling to quiet them down so he could pull in some of the rarer DX locations and the "rat" person rose out of bed with that sheer panic-stricken look of terror again written across his face.

Pileups

Unfortunately, the group was not able to work all of the stations who wanted to work us, yet we were enthusiastically received by amateurs worldwide. Everyone participated in the spirit of amateur radio and brotherhood in an orderly manner, and the operators were QSLing those with SASEs to beat the new postal rates. Not one of us seemed to have thought of this, but a lot of the other stations who have QSLed have thoughtfully taken this into consideration and we graciously thank those who had more foresight in this area than we.

Incidentals

On every Dxpedition, the operator should consider taking along items which would have meaning and promote friendship among the individuals with whom we spend time. Fortunately, the operators took along some of the necessities which are not always readily obtainable at an economical cost on the island: soap, cigarettes, and articles of a radio nature for Father Dave.

When you consider putting seven people plus four amateur radio operators in one home, you can just let your imagination run wild on how most people would get along in an average American home. Fortunately, there was never a problem in spite of what little TVI or RFI we caused, and there were always pleasant words exchanged from early morning to late evening. We even performed babysitting duties and a little bit of emergency first-aid when one of the children of our host family cut his hand on a piece of broken glass. We used bandaging in the form of good old black electrical tape, which provided for a clean wound until the child could get down to the hospital and receive stitches by the doctor.

It is interesting to note that Easter Island, while being so remote, has a hospital with two doctors able to perform surgery and take care of any emergencies or illnesses. The hospital was prefabricated in Florida approximately ten years ago and shipped directly out to Easter Island. It includes all the modern conveniences of our hospitals, with x-rays, laboratory facilities, and

Here we are ready to leave, with the beads of the island around our necks. From left to right, Hugh, Steve, Father Dave, George, and Dick. Father Dave was prepared to pick up the new Mother Superior who was arriving on our departing flight.

dentistry. It was good to see, too, that there was a tennis court on the hospital grounds.

Toward the end of the week, the operators were beginning to become DXed out and beginning to think of home, especially with the wish to take hot showers, since none of the facilities on the island had showers except for the motels.

You can only do so much operating before becoming DXed out. Toward the end of the week and approaching 2,500 contacts per operator, operations were becoming more difficult due to lack of sleep and the constant pileups.

Departure

Leaving was much easier to do than arriving, but certainly was one of the sadder moments of the trip. Prior to the night of departure, we were visited by the English-speaking daughter of the local police sergeant who had previously stopped by a day earlier to ask what all of the shiny new antennas were for and to inspect our license documentation. It certainly was important to have proper documentation of the licenses issued by the Secretaria de Telecommunicationes of Chile, and upon presenting those to the sergeant, the only word from him was "perfect." Had we not had our licenses in order, God probably would have had us operating our DXpedition behind bars. It is important to observe the proper international regulations and laws of the host country.

The following night the sergeant dropped over with his daughter, so she could practice her English with our group, and it made for a very enjoyable evening. Our hosts and the operators exchanged gifts, took pictures, and hugged one another before an early bedtime. As the plane flight was oversold by *only* thirty seats, it was important to plan on an early arrival at the airport for seat selection.

Driving to the airport with Father Dave, I expressed to him that I really wouldn't have been disappointed if the plane had not come for another couple of days, as I would have happily continued operating. Unfortunately, the Lan-Chile flight arrived right on time, which, considering the five-hour flight across the ocean to Easter Island, was amazing. The group loaded into the plane and bade farewell to those who had come out to the airport to see us off. This is quite a custom and included decorating our group with native-made necklaces. We were to depart for home by way of Santiago.

W4PRO and W4GSM and their stations arrived on the same aircraft that we left on. They were met by Father Dave, who was picking up the new Mother Superior, which naturally had to take preference over the arriving amateurs. The other amateurs were to continue operations for the next month and also were to share operations with Chod Harris who was arriving on an archaelogical expedition.

Santiago Festivities

Arriving at the airport, I continued home to my patent law practice in Minneapolis, while the other three operators laid over in Santiago and went to a steak fry the following evening at the QTH of Patricio CE3GN. The Radio Club de Chile overextended their courtesies and provided for a fitting end to a DXpedition, which included gracious hospitality by the amateurs of their city and the country of Chile.

Chile is a very European country which exhibits very interesting French Provincial architecture along with people who are the most caring I have ever seen. You cannot really appreciate their hospitality until you spend time in their cities or fly on their airline. The hospitality was really overwhelming.

Tying It Up

On arriving home, all of the operators found stacks of QSL cards, and the first thing my neighbors said to me was that they knew we were busy down there because they had a large grocery bag stuffed full of QSL cards. Equipment had to be returned, accounts had to be divvied up between the operators, and equipment repairs had to be undertaken for our transceivers which were brought home in a state of makeshift repair. Fortunately, all of these were small matters, but all these things take time, including the unpacking of bags, returning of equipment, washing and cleaning of clothes, and processing all of the photographs that had been taken, including those that appear here.

After being home a week, thank-you notes were still being written and requests from others are still being undertaken and fulfilled. We tried to beat the postal rate hike, but then there's the processing of other cards which are expected to arrive over the next year or two, possibly from the bureaus.

Conclusion

As far as the operators were concerned, the DXpedition was a success, and people in Chile as well as others along our route have a much better feeling for amateur radio and what amateur radio is. The group was very careful to leave behind the true reputation of the spirit and brotherhood of amateur radio so that others will be welcome in the future, whether it be on Easter Island or at some point in between. Truly, it was a remarkable experience for all the members of the group and for the others who came into contact with us. It is something that will be remembered for the rest of our lives as being very rewarding and highly fulfilling. The members of our DXpedition strongly encourage those who are able to to undertake such an DXpedition should the opportunity ever arise.■

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Jocelyn O'Donnell WB2CMB
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A Very "Special" Weekend

—hams help New York's Special Olympics run smoothly

The motto of the 1981 New York State Special Olympics was "Let me win, but if I cannot win, let me be brave in the attempt" and it had a very special meaning to the Rookies Amateur Radio Association of Elmira Heights, New York. This is our story of a weekend for all to remember and the part amateur radio played in this unprecedented event.

I suppose one might say it all began with the 1980 Summer Games held in Elmira, New York. The amateur radio community was approached to provide communications for the event. After much planning and hard work, the 1980 games went on without a hitch. In fact, the state committee was so pleased with our communication efforts that they not only decided to make amateur radio a permanent part of the Special Olympics, but also elected to return to Elmira for a second consecutive summer. Never before in Special Olympic history had the event been repeated in the same town two consecutive years.

Special Olympians are really special.

Our goal now was not just to provide communications, but to provide *better* communications in 1981. In order to do this, planning for the June 13th weekend began in October, 1980. Every Wednesday evening for the entire winter, Frank Freeman WB2LMB could be found at Elmira College, meeting with the executive committee of the Special Olympics. Because an amateur was asked to be a member of the executive committee, this enabled us to provide more efficient communications. Information WB2LMB gained at these planning sessions was brought back to Jack Daugherty WA2DGS, who was in charge of organizing, assigning, and scheduling all volunteer amateurs and equipment for the Rookies and all area amateurs.

Our work for Saturday's event began Thursday evening, June 11th. There was much to be done. Assembling both two-meter net-control stations became first priority. A conference room in the college campus center was transformed into communications headquarters. Meanwhile, a crew was at Southside High School pitching a 20-man tent and tuning their new 80- and 40-meter bazookas. When all the groundwork was complete, a 32' tower and triband beam were erected. Late Thursday evening, all equipment was in readiness.

Friday morning came quickly to those who helped the previous evening, but by 7:30 am Bill MeadeKA2BED officially called the N3AQ .96/.36 repeater to Special Olympics traffic status only. By 8:00 am, 25 hams were at their assigned posts awaiting the arrival of buses from all 36 areas of New York State.

At the public address desk: WB2UOG, WA2FJM, KA2CLI, and WA3EBG.

A shot of the PA system, the low-band tent, and tower and beam.

Meanwhile, various amateurs were heard checking with net control concerning their weekend assignments and last-minute scheduling changes. It was really gratifying to see amateurs give so freely of their time to help, but to be staffed so well and running by noon Friday seemed really incredible, considering most had to find a way to be absent from their places of employment.

By 12:00 noon, along with bus arrival came K2GOO, a representative of a New York City amateur radio club. Since amateur radio is now to be a permanent part of the Special Olympics, an amateur representative from next year's host city was sent to observe our operation and the services that we provided.

By 1:00 pm, buses were arriving in a steady stream. Hams posted at the exit of the expressway stopped all buses and they were checked in with net control and assigned courtesy cars to follow through the city to the college.

At 2:00 pm, the 26 members of the executive committee had met with their personal amateur communicators. This enabled all members of the committee to be in constant contact with each other for discussions of hundreds of last-minute details. This chore took communicators to many areas, from Southside High School to the Chemung County Airport.

By 6:30 pm, most of the Olympians were settled into their living quarters and awaiting the evening's activities. By this time, roving Red Cross teams had been established and a communicator was assigned to each team. A second net was established on the .10/.70 repeater with net control at the college health center.

At 7:30 pm, the parade began to progress through downtown streets toward the main campus for opening ceremonies. Amateur radio operators ran at the beginning, middle, and end of the parade to provide information on the parade's progress through the city streets. Finally, the climax of the parade arrived—the torch bearer to light this year's Olympic torch. Close behind was his communicator, relating torch progress to net control. Although some of us had difficulty keeping up with our assignments, this had to be one of the most difficult.

At 9:00 pm, news from N3AQ, stationed at the airport, indicated that Governor Carey had indeed landed and would be rapidly proceeding by state-police escort to the site of the block dance on main campus. After a few words to the Olympians, he joined the band in a dance with his wife.

By now, approximately 65 radio operators were working in their assigned areas. As the music of the block dance rang in our ears and the children danced, our activity began to wind down. One exception, however, was the communicators with the roving first-aid crews.

By 11:30 pm, cleanup complete and all first-aid crews relieved by the Elmira Fire Department paramedics for their 11:00 pm to 7:00 am shift, the N3AQ Rookies repeater was released for normal use.

All in all, the first day went quite smoothly. One lost athlete was found quickly and there were only a few minor medical problems— bellyaches and pregame butterflies.

To most amateurs who worked Friday evening, Saturday arrived too quickly. At 6:00 am, personal communicators met with their assigned executive committee officials. KA2BED once again opened the .96/.36 repeater to official Special Olympics net traffic, for administrative messages. Meanwhile, the .10/.70 repeater handled a net for statistical data and various other traffic. Communicators aided in loading the many buses for the ride to the games' site.

9:00 am saw all contestants at the high school awaiting the torch bearer's arrival from the college. After a very touching ceremony and lighting of the

John N2AFW directing spectators to proper area.

Some of the crowd at the 1981 Special Olympic Games.

torch, the games officially began.

At this point, over 125 amateurs were involved in the event, providing communications with thousands of dollars worth of equipment. Of course, all this was at no cost to the Special Olympics and any cost incurred was absorbed by the Rookies as part of their community service.

Was it all worth it? After 6 hours out in the blazing sun, many may have wondered. This question was quickly answered with the smile of a winning athlete as he proudly ran up to you to show off the medals he won. It definitely was all worth it!

The 3:45 pm closing ceremonies were followed by the extinguishing of the torch until next summer in New York City. Bus loading began for the return to the college, and by 7:00 pm, all were reloaded for the trip to the victory dance at Elmira College's Murray Center, eight miles away. This dance was for the 1000 Olympians, 400 chaperones, and over 1500 volunteers. By 8:30, the victory dance was hopping. I personally don't know where they got all their energy. We again supplied security and first-aid communications.

By Saturday evening at midnight with all the buses back at the college, 85% of the Olympics were over. With nearly 4000 manhours of work behind us, we still had to secure the nets and get ready for tomorrow.

Sunday morning at 8:00 am, the .96/.36 net traffic resumed. Buses were checked out as they left the bus parking lot, loaded, and departed from the dorms. By 12 noon, all participants were on their way home.

What are our final thoughts now that it is all over? We would do it again without a doubt. This was a very satisfying and beautiful experience. Not only was it satisfying from a personal aspect, but also because of the banding together of all the amateurs from the southern tier of New York and the northern tier of Pennsylvania for a common cause. On a larger scale, you saw people from all walks of life in the community giving their time and individual talents to work together toward one common goal: providing the best Olympic Games ever for the children. Amateur radio operators were proud to have done their part for this common cause and to have served their community.■

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Tom Bowman WA3REY
4 Judy Drive, RD #3
Annville PA 17003

Getting Ready for the Real Thing

— emergency preparedness that works

We picked our way carefully through the staging area out onto the open road. Clusters of brightly-colored tents and campers dotted the field. Strapped in the passenger seat of the open jeep, I warned Dave WA3THB whenever motorcycles crossed close to us. It was a hot, dry Memorial Day weekend at Fort Indiantown Gap in southeastern Pennsylvania. During the seven years that we had provided ham radio communications for the motorcycle enduro, this was the best weather we ever had.

Photos by WA3REY

The 146.04/.64 portable repeater atop Second Mountain. Don WB3AXO (left) and Keith WA3UDJ.

Up ahead the road straightened out as we ran the length of the valley. A thick plume of dust followed us as Dave picked up speed. The dust blocked my sight of the ambulance following close behind. The quick rise and fall of the ambulance siren told me that they were still with us. Quick jabs of the siren pierced the dust. I held on tighter. I was on the edge of my seat watching the road and the front right wheel, some three feet away. My cameras swung wildly from their neckstraps as Dave turned onto Cold Springs Road. The front tire whined as we came out of the turn.

"It's got to be right up ahead," Dave yelled above the siren, pointing towards the base of the mountain.

"NCS, this is W3FEY," the portable repeater on top of Second Mountain came to life. "Request that they expedite that ambulance, Net Control." George, W3FEY arrived at the scene of the accident and gave us the location. We were leading the ambulance to a motorcycle and car accident that happened a few minutes earlier along the enduro route.

Up ahead, a tight knot of people surrounded a downed rider lying in brush along side the road. Dave ran the jeep into a field. The ambulance passed us on our right. Grabbing cameras and HT, I followed Dave and the ambulance crew to the injured rider. George was standing in the road with an HT.

"W3FEY, this is Net Control."

"This is W3FEY."

"George, we got a request to get somebody from the Trail Riders to go up the road and block traffic so we don't have anymore trouble." Net Control's request was answered as George and a rider headed up the road.

"Hang in there, John, keep talking to me. Don't go to sleep, John," one of the EMTs was saying as they worked on the injured rider. "Keep talking to us, John. Don't go to sleep," the EMT kept repeating over and over again as they loaded the rider into the ambulance.

This was the first of five injuries on the enduro course that day. Ham radio directed each rescue.

Beginnings

In 1974, Jim Moore W3ASA, then president of

Frank N3RZ stands next to his portable repeater, a .70/.30 220 repeater linked to the main .40/.64 machine to extend coverage. The duplexer is in front seat, the machine and battery in the back, and the antenna is on the car roof.

Keith WA3UDJ at the starting line.

the Valley Forge Trail Riders (VFTR), persuaded a few hams to help his club provide communications over the 100-mile enduro route. The Moonshine Enduro takes its name from Moonshine Church, located next to the staging area.

The enduro trail starts from that staging area and snakes its way up mountains, across streams, and, in general, takes the most difficult, indirect route between start and finish lines. Jim repeatedly told us that the enduro is not a race. Instead, it is a course marked with paper arrows. Checkpoints dot the course. Riders have a specified time to travel from checkpoint to checkpoint. They are penalized for arriving early *or* late. The VFTR marks the riders' time cards as they arrive at each checkpoint. Hams have one basic job—communications. With 12 checkpoints along the route and between 300 and 500 riders, that means a lot of messages. Messages are either emergency or routine. The NCS directs the net from the staging area.

After seven enduros, I've come to some conclusions about things that have worked for us. A few of them are technical; some of them are operational. All of them are common sense. If you are at all interested in improving amateur emergency communications, stay with me. But don't limit these ideas to enduros only. They just might work during the next Hurricane Agnes or TMI.

Technical

The first two years, we attempted the impossible. We tried to cover two mountains and a valley on .52 simplex. The VFTR laid out 12 checkpoints over an area about 10 miles long and 5 miles wide. Not only was the enduro route tough for the riders, but it was rough on rf. At times, I've believed the VFTR purposely placed key checkpoints in the rf shadow of a mountain.

My main complaint with simplex operation over the enduro course is that all stations cannot hear each other all of the time. An early-morning situation might impact on stations later in the day. For instance, this year, course-direction arrows were maliciously removed early in the enduro. By operating through the repeater, all checkpoints were aware of the situation throughout the day. The other problem with simplex operation is the constant need for relays. This takes time. The NCS was located in the staging area. When operating simplex, a relay station had to repeat many of NCS's transmissions for outlying checkpoints. Solution: Replace the relay station with a repeater. Chances are very good that if you can get a ham into an area, then you can also put a portable repeater there. You might as well go first class and use the repeater as the relay. Put the ham somewhere else, where thinking and decision making is required, such as at a checkpoint.

People

"People" also can be read as "volunteers." There are 12 checkpoints with, ideally, two hams to a checkpoint and the NCS, one ham for each of the ambulances, and one or two hams to ride dirt bikes into remote areas. That's at least 30 volunteers! Find me 30 volunteers, all hams, willing to give up one-third of their Memorial Day weekend. Sound impossible? It is, unless the event is really outstanding and you understand volunteers.

Ever wonder why the ARRL has so little participation in its simulated emergency tests or why the local radio club has a bad turnout for weekly RACES nets? And why does the local emergency coordinator have trouble filling out his yearly activity report? You've all heard them complain that hams are like everyone else. They don't want to get involved. They say that hams are complacent.

They *are* right.

Hams are complacent about simulated emergencies. Think about that. *Simulated* emergencies. Do you really get turned on by the idea of a simulated hurricane hitting Anytown, USA? If you do, I've got this nice piece of swamp land I'd like to talk to you about...

The problem is that there is very little that gets the adrenalin flowing during a simulation. That's why emergency tests and practice nets are failures. Why not give your volunteers the real thing—or at least a chance that the real thing might happen? If you can't find a motorcycle club with an enduro, then find a police chief up to his armpits in Halloween pranks. Or a citizens' crime watch patrolling the neighborhood with 100-mW CB HTs ("...Hey! Want to see how I can dial 911 through my Wilson HT?"). The idea just might catch on.

Ron K3TZJ, middle, with white shirt, watches from a safe distance as scores are marked by the checkpoint team.

I guess the greatest *simulation* of them all is Field Day. The club plans all year long how it's going to be tops in the *QST* listing. Everybody takes off that weekend for the country with emergency power from real emergency generators. I think you get extra points for that. Anyway, when the 24-hour emergency is over, everybody packs in the KWM2, the tribander, and the empty beer cans and heads home. Terrific emergency preparedness.

The first thing I don't understand, and I'm sure someone will help me, is why are all those hams running to the country when the emergency strikes? The other thing I can't quite figure out is if it's such a great emergency exercise, why didn't all those prepared contesters help us back in 1972 when Hurricane Agnes flooded the east coast during Field Day weekend.

Let's face it. Field Day is a great contest, but it's really only a simulation.

OK. You've got your enduro or crime watch or public transportation Guardian Angels and you are ready for the real exercise. Now you need people, pronounced, "volunteers." Two things are important here. First, don't limit your exercise to club members only. Find volunteers both in and outside of clubs. Just because a ham isn't a joiner doesn't make him a bad communicator. In the event of an emergency, the guy is a volunteer first and a club member second. During TMI, the only prerequisite was a valid ham license. ("I've got this great shift for you in the Hershey Sports Arena watching TMI evacuees from midnight until 3:00 am! You can join the club later.")

Now for the second thing about volunteers. There is no faster way to turn off a volunteer than to persuade him to leave work early and lose half a day's pay. Then, when he arrives on the scene, let him stand there with nothing to do. If you request volunteers, make sure that there is meaningful work for them to do or you probably just lost a future resource.

Estimating the number of people needed to do a job is difficult. During TMI, I estimated wrong. I was a local township CD director and I requested five more people than I actually needed to help me evacuate a nursing home. When the five volunteers arrived, the fire company had almost finished carrying bedfast residents into waiting ambulances. The county CD director saved me. He suggested that I find substitute work for those five people that were kind enough to lose a half-day's wages. Those volunteers did a great job cleaning, carrying, and loading cots from the nursing home onto waiting trucks destined for the mass care center. The task was modified, but they donated 15 valuable manhours during the emergency.

Operations

Our enduro taught me one lesson I won't forget. If you are assigning hams to checkpoints, give the guys a break. Assign two-man teams whenever possible. Many times, such as in an enduro, the terrain will be unfamiliar and two hams will work better than one.

Case in point: Three years ago, at one of the enduro checkpoints, the nicest-looking 100-pound female checkpoint crew person was run over by 450 pounds of enduro bike and rider. This happened on one of the many trails that criss-cross the area. It wasn't too difficult to find the macadam road and to flag down the ambulance. The hard part was finding the right turns to take to lead the ambulance back to the injury. The trails all looked the same to me!

After trying three wrong trails, I called for help. Don WB3AXO saved ham radio's and my reputation that day. He rode his dirt bike along the enduro route until he found the accident. Then he talked me and the ambulance into him. The lesson is simple. Teams of two hams in unfamiliar territory work better than one ham alone.

Let's assume you've got your teams and you are ready to begin. Our operation isn't much different than everyday repeater operation. The big difference is that the repeater is closed. The NCS courteously tells stations outside the event that the machine is closed for the duration of the project. All stations request permission to communicate with other net stations. This is about the only formality needed to control the net.

There are only two kinds of traffic: emergency and routine. We don't use ARRL message forms, nor do we use standard texts. Sorry, this is the real world. It's much faster saying it and, if required, repeating it, than sitting down at a checkpoint and composing a message, counting the words, assigning the priority and handling instructions, etc. That stuff is great for 75 phone nets but it sure isn't needed on a 2-meter FM repeater.

And remember, good ham operation is measured by only one thing, effective

Accident! Dave checks location on map (WA3THB in center).

Accident! Dave WA3THB, holding blue bag and HT, as ambulance crew prepares to load.

communications. From the beginning, everyone is briefed on the mission. We are there for one reason and that is to communicate. We don't put arrows up on trails, pick up wrecked bikes, or mark score cards. The same thing applies to other activities. If you are working with a crime watch, you don't apprehend criminals. That's police work. In short, we are communicators.

Have Fun

I'm afraid to this point I've been pretty serious about injuries and nets and things. But there is a fun side to it all. Whatever event you choose, it just has to expand your life. Seven years ago, I thought dirt-bike riders were troublemakers—a little lower than the Hell's Angels and a little higher than Pagans. Wrong again. They're family people. And they have fun. That's the other nice thing about these activities. For one day, you mix with all kinds of people. There's time to swap ham stories and time to learn about motorbikes. But when it's all over, the best thing is that good feeling from a job well done that comes back to you every time you remember last year's enduro. ■

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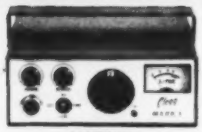

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Paul Grupp KA1LR
73 Magazine Staff

The FRG-7700 General-Coverage Receiver

—a first-rate rig for the shortwave bands

Yaesu has been producing shortwave general-coverage receivers for some time now, and their latest offering, the FRG-7700, obviously benefits from that experience. This machine represents a serious attempt to produce a receiver that is free of the shortcomings that plague many similar units, an attempt which largely appears to have succeeded! With no further ado, let's look at what the Yaesu has to offer.

The Features

The FRG-7700 is a PLL synthesizer-controlled receiver, boasting upconversion to a first i-f at 48 MHz. It covers the entire spectrum between 150 kHz and 29.9 MHz in one-MHz steps. For convenience, there are ten additional positions on the bandswitch for the ham bands. Both digital and analog readouts are provided and bandspread (tuning rate) is good for a receiver of this type. The tuning knob covers about 40 kHz per revolution, and all tuning is accomplished with a single tuning knob—gone are those irritating secondary controls that plagued early general-coverage receivers.

One of six bandpass filters is diode-selected by the bandswitch, allowing Yaesu to dispense with preselector and peaking controls. A 12-frequency memory is available as an option, which allows frequencies to be dialed up with the main tuning knob, stored with the push of a button, and recalled at will with the 12-position rotary M CH switch. A fine-tuning control with a range of about four kHz is provided for these memory channels.

A rotary switch selects mode: FM, LSB, USB, and AM. Three levels of selectivity are provided in the AM mode—2.7, 6, and 12 kHz at the −6-dB points. Selectivity in the SSB modes is rated at 2.7 kHz, and for FM it's 15 kHz. CW signals are tuned in either of the sideband modes, using the 2.7-kHz filter.

Other useful items found on the front panel include rotary attenuator, noise blanker on/off switch, volume and tone controls, agc fast/slow switch, panel-light dimmer switch, squelch for FM, two audio output jacks, and a speaker.

A 12-hour clock is included in the 7700's circuitry, and a number of front-panel switches are devoted to its various functions. These are clustered in the upper right-hand corner, and provide for setting the radio's on and off times. A countdown "sleep" timer allows you to program the radio to shut down after a period of up to 59 minutes. Time is displayed with the same readout as the frequency display, and a switch selects display of either one. Since the clock display can be left on while the rest of the radio is shut off, the FRG-7700 is an exotic but practical substitute for the more mundane AM/FM clock radio.

Rear-panel options are

The FRG-7700 general-coverage receiver.

Continued on page 121

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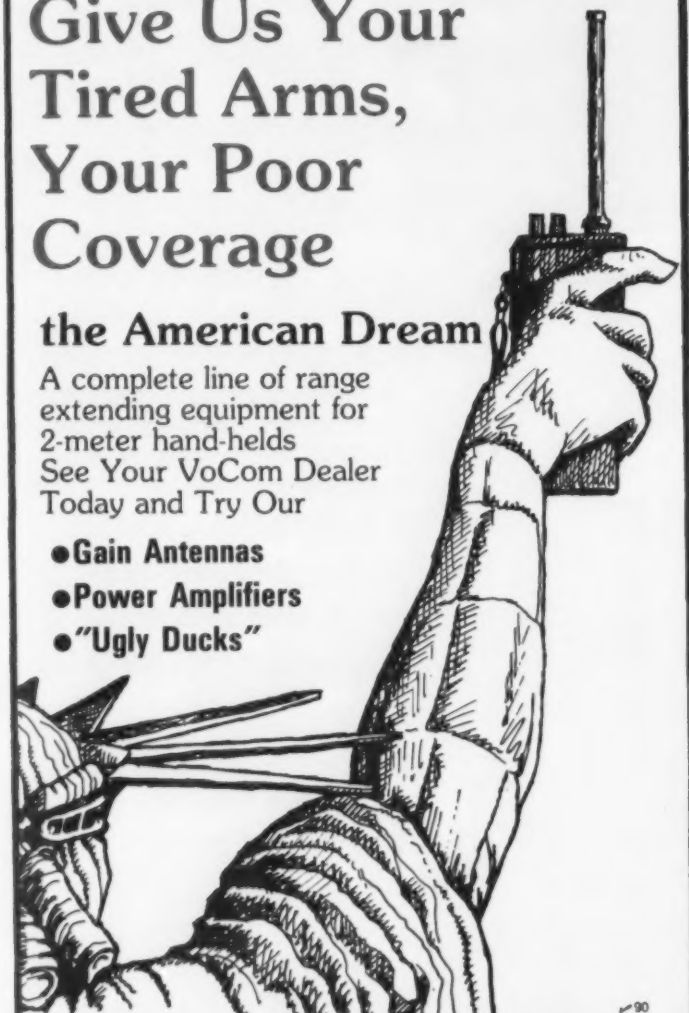

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Two Meters Getting A Little Boring?

—maybe you need to try crossband DXing

I was enjoying "the best cup of coffee in Pine Grove," according to Denny Gibson K3SLG. It was one of those cold January mornings when you drink 3 cups of coffee just to put off that inevitable walk to the truck. Lehman's Luncheonette was warm and friendly in the small Pennsylvania coal region town. Denny and I talked about converting the Regency high-band transmitter on the table in front of us to use in the Palmyra repeater. After the third cup of coffee, I picked up Denny's Icom IC-2AT HT and looked it over closely.

"Dial up 145.25 and try it," Denny suggested. The thumbwheels clicked in place showing "5.25" on top of the HT. A full-quieting kerchunk came back in reply to the Icom push-to-talk switch.

"So where's the new repeater?" I asked, a little puzzled. For as long as I had operated 2-meter FM, Pine Grove was famous for having one of the best repeaters in the area. The 146.64-MHz machine had been operating on nearby Blue Mountain for the past 7 years. Denny was the owner of that repeater and was responsible for putting Pine Grove on many a ham's map through the repeater's reliable service and friendly operation. Now there apparently was a new subband repeater somewhere close by and my curiosity was growing.

"Where's the new machine, Denny?" I said impatiently.

"Across the street in my basement," he smiled. "It's all clip leads and parts lying on the bench right now, but I want to package it and put it up on the mountain alongside the .64 repeater."

Denny K3SLG shortens a CB antenna to 10 meters.

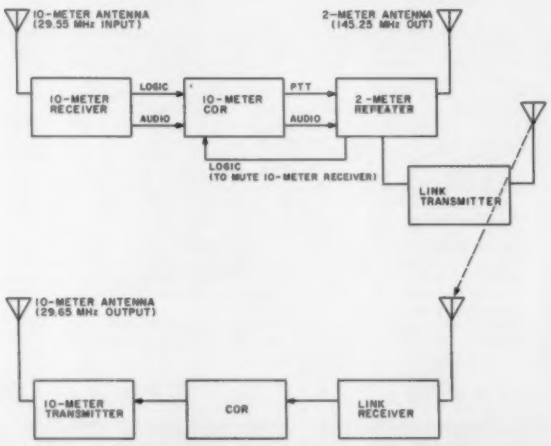

Fig. 1. Pine Grove 2/10-meter crossband repeater.

Denny K3SLG checks 10-meter FM with an Azden rig.

Close-up view of the 10-meter receiver and the Standard repeater with K3SLG.

Denny went on to explain that it was linked to a 10-meter repeater and had been on the air for about a week.

Somewhere in the back of my mind I remembered Don Yorty WB3AXO talking about converting a low-band RCA Supercarfone to 10-meter FM.

"The output is down at Don's house. He's using a Carfone on 29.65 MHz into a cut-down CB antenna," Denny added. "It runs about 100 Watts from a pair of 6146s."

Don lives a few miles east of Hershey, Pennsylvania, about 15 air miles south of Pine Grove.

"I have the receiver strip from the Carfone on my workbench. We're using my tribander for the 10-meter receiver antenna." Denny went on to describe the rest of the equipment. The 10-meter receiver was tied into a Standard 2-meter repeater and duplexer.

"We worked Germany, Sweden, England, and the Scottish Highlands through it since it's been on the air," Denny answered. He must have been reading my mind, I thought.

As we talked, the Icom 2AT kerchunked randomly on what sounded like noise bursts.

"That's something on the 10-meter input," Denny explained. "It comes and goes when the band is open."

But so far I didn't hear any Germany or Sweden. Just a sweeping carrier going across the 10-meter input. Oh well, I thought, to each his own or something like that. I guess it's the variety that makes ham radio interesting. No sense in getting all excited about DX on a 2-meter repeater, I concluded as I handed the HT back to Denny.

I picked up the Regency transceiver and headed across the street in the cold January morning. Turning my truck around I picked up Interstate 81 and started the long drive home. What the heck, I thought, I might as well dial up the new repeater and see how far out on the interstate I can hear the machine.

On 145.25 MHz the static bursts were replaced by a QSO. WA3YMU was working a station in Scotland. The Scottish GM4 station mentioned how glad he was to hear that our 52 hostages had been freed. He talked about how closely Europe had followed the whole ordeal.

Somewhere out there on the interstate, that QSO sparked new interest in me. Things had been going downhill in my ham radio hobby ever since my Novice days. I can still remember how exciting it was to work stations using CW with my old DX-20 and HR-10 receiver back when I was a WN3. After I got the Advanced ticket, my new TS-520, and some FM gear, things began to cool down.

But here I was again, feeling just as pumped up as when I was working stations on the Novice bands. This was something *really* different. Ham radio was unique again. Here was the chance of working Europe from my Datsun truck on the interstate. Or maybe even taking my Wilson HT to work some morning and sitting down at my desk and monitoring 145.25.

I'd be cool about it. I'd just let the HT sit there on my desk and wait for the band to open. The guys in the office would ask where that station was from and I'd say, "Oh, that's Tom over in Aberdeen, Scotland." Or maybe it would be Klaus in Denmark. Anyway, I'd pick up the HT and work Sweden or Denmark or Scotland right there from my desk.

I woke up at the next exit and turned around, headed back to Pine Grove. I wanted to learn more about this new crossband repeater.

A Closer Look at the Repeater

A glance at Fig. 1 shows what I learned about Pine Grove's 2-meter/10-meter crossband repeater. The equipment at the top of the diagram is located at K3SLG's home in Pine Grove. The 10-meter receiver is an old tube strip from an RCA Supercarfone. The 2-meter repeater is a Standard repeater with a duplexer connected to a 2-meter antenna on Denny's backyard tower. A link transmitter sends the signal to be repeated on 10 meters to Don WB3AXO, whose station is 15 miles away.

The 10-meter output at Don's home is quite simple. A link receiver picks up the Pine Grove signal and couples it through a COR into the 10-meter transmitter. Don converted the transmitter strip of the lowband Carfone to 29.65 MHz. The transmitter antenna is a $22 Channel Master 1/2-wave CB antenna cut down to 10 meters. It stands on top of Don's TV antenna tower.

The entire 10-meter transmitter package is about 2 feet high and sits neatly in a cabinet in the corner of Don's living room about 4 feet away from his wife's TV set.

Don invited me to his house one evening to show me the package. As he tuned up the transmitter, he pointed to the needle on the wattmeter as it came to rest on the 100-Watt mark. Don's wife sat next to him watching Buck Rogers' latest adventure on the TV, oblivious to the whole tune-

"Communications via 10 and 2 FM," 10-meter Carfone receiver, Icom 2AT.

Don WB3AXO with 10-meter Carfone transmitter.

up procedure. Obviously the 6146s caused no TVI.

Back to the top of Fig. 1, the block marked "10-meter COR" is the heart of the Pine Grove repeater system. The 10-meter COR looks into the 10-meter receiver squelch circuit. When it sees a 10-meter signal it closes a relay. That relay does 2 things.

First, it turns on the 2-meter transmitter by grounding the PTT line in the 2-meter repeater. The relay also couples 10-meter received audio into the 2-meter repeater transmitter.

When the 2-meter repeater receiver picks up a signal, the 2-meter repeater COR turns on the 2-meter repeater transmitter. At the same time, the 2-meter repeater COR sends a logic signal back to the 10-meter COR. The relay cuts off audio from the 10-meter receiver. This prevents random noise from being repeated along with 2-meter audio. The action of the 2 CORs gives priority to 2-meter signals over 10-meter signals in the Pine Grove system.

The 10-meter COR used at Pine Grove was taken from a GE Master Pro 4-channel scan head. Any similar COR could be used that turns on when the 10-meter receiver sees a signal.

Problems on 10 FM

Back in Pine Grove, Denny told me about some of the misadventures he ran into while putting the new machine on the air.

Finding a 2-meter frequency was relatively simple. Denny searched the 2-meter band using his Kenwood 7800. It was obvious that the only choices fell in the new repeater subband. Denny called Joe WA3GMS, the area frequency coordinator, and talked over a list of 4 proposed frequencies. They agreed on 145.25 MHz for the 2-meter output with a standard input down 600 kHz. Finding the 10-meter pair was a little more difficult.

At the suggestion of a local ham, Denny and Don chose 29.64 MHz for the repeater output with a standard input down 100 kHz on 29.55 MHz. The crystals were ordered for both repeaters and tune-up and testing began in early December. The repeaters were linked and on the air for 2 days when Denny remembers a short QSO he had with a veteran 10-meter FM user.

"It was our second day of operation on crossband. This W7 came on just as I was signing clear with a local station through the 2-meter side of the repeater. I asked the local to pick up the W7 because I had to get to work.

"The W7 said, '. . . No, I want you, K3SLG.'

"So I asked what I could do for him. He told me in no uncertain words. I can still remember. He said, 'Hey, old man, where are your brains?'

"I asked him if he'd care to explain what he meant. He said, 'I don't know where your brains are. . . You're on a well-established repeater frequency. Since you guys came on we can't work through the Metroplex repeater.'

"We told him we understood now after some 10-meter operation that 29.64 MHz is probably the most crowded 10-meter frequency and that we planned to move . . . that we were only testing. But that really didn't seem to satisfy him."

It was clear early on that finding a good 10-meter pair was going to be much more difficult than finding frequencies on 2 meters. For one thing, Denny found no rigid band plan as on 2 meters.

There are 2 acknowledged simplex frequencies on 10 FM, 29.5 and 29.6 MHz. Four repeater pairs round out the band plan: 29.62 MHz, 29.64 MHz, 29.66 MHz, and 29.68 MHz with respective inputs 100 kHz down on .52, .54, .56, and 29.58 MHz. But with a little more listening, repeaters were also found on 10-kHz splits.

"The repeater pairs given in the band plan were too crowded already for us to fit in . . ." Denny noted. "So it was like using a shoe horn. We squeezed in on 29.65 MHz and have been having good luck there."

Denny looks at coordinating 10 FM as pretty much an impossible job because of the band conditions.

"What you probably wouldn't tolerate on 2 meters you shrug off on 10-repeater overlaps, heterodynes and simplex operation on the repeater inputs. Coordination on 10 meters has been set at 1500 miles. That's half way across the country. If you take 4 repeater pairs like they have set up and spread them across the country, that gives you very few repeaters.

"That's why we moved to 29.65 MHz," Denny concluded.

The new crossband repeater's problems didn't end with the new frequency. A carrier sweeping across the 10-meter band keys up the repeater on a random basis. Denny and Don found that not only Pine Grove but also other east coast repeaters were being hit by the carrier.

Denny described it to me as "...an erratic series of transmissions like someone coming on frequency with multiple key-ups. The carrier remains there for a second or so, then disappears. Sometimes it sounds like a gunshot."

K3SLG calls the sweeping carrier the repeater's number one problem. Tom GM4HIG in Aberdeen, Scotland, hears it in Europe and terms it "a propagation phenomenon." Operators aren't at all sure if it is related to the Russian woodpecker. Ski W5MYH in Truth or Consequences, New Mexico, reports hearing the sweeping carrier on other east coast 10-meter repeaters.

Denny has considered building a delay into the repeater to prevent the key-ups but concluded that the variable length of time the carrier stays on frequency would probably make the delay useless.

Equipment for 10 FM

Listening to stations using the 10-meter side of the repeater reveals quite a mix of rigs. I've heard many Yaesu FT-901s, especially from Europe. The Azden PCS-2800 is another very popular rig used here in the states. The preprogrammed −100-kHz offset makes the rig as easy to use as my Clegg FM-28 on 2 meters.

I've heard of some hams in the York, Pennsylvania, area that have made a club project of 10 FM. It looks like the Pierce-Simpson Tiger 40A is the rig they like to convert. One of their members has a kit available to convert the 40-channel CB rigs to FM. I understand that the kit includes FM limiting and improved squelch action. More about the conversion as it becomes available.

For the present, I plan to operate through the 2-meter side of the repeater by using my Clegg FM-28. I can't forget my Wilson HT either. I have a set of crystals ordered. As soon as they come I'll be working Europe from my desk at work...

What's Ahead

Denny tells me that the next step in the crossband repeater's growth is getting it out of his basement and up on the mountain alongside the 146.64-MHz repeater. When that happens, the 145.25-MHz subband repeater and the 10-meter receiver will be housed on the mountaintop.

The final move will bring the 10-meter transmitter from WB3AXO's home up onto the mountain. Denny is negotiating for space at a site about a mile east of the present .64 repeater. He believes that should provide enough horizontal separation between transmitter and receiver to avoid desense. The two sites should be close enough, however, to provide a balanced 10-meter repeater for local hams working through the 10-meter side.

The whole system has been designed with simplicity in mind. The crossband repeater is open. No special tone control is required to use it.

In K3SLG's words, the crossband repeater "...gives the 2-meter hand-held or mobile operator the capability to work the world. It really gives ham radio an edge when compared with other radio services."■

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Icom 2AT works Europe through the crossband repeater.

Left to right: Denny K3SLG, Don Melnicove, and Dave Lehman WA3ZEG gather in Lehman's Luncheonette to discuss 10-meter DX through the crossband machine.

See List of Advertisers on page 114

Ralph G. Swanson WB6JBI
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A Lot of Hot Air

—keeping balloons aloft

If you are wondering what the relationship between hams and balloons is, read on.

It all started in 1979 when Dr. Tom Heinsheimer, an aerospace scientist with a sincere love of ballooning, according to Nate Brightman K6OSC, decided to revive the once-famous Gordon Bennett International Cup Race. The race continued with great popularity through the years 1906 to 1938. World War II quenched the race and nothing was done until 1979 when Dr. Heinsheimer caused its revival. Enter amateur radio!

Nate was approached by Dr. Heinsheimer to provide help with the logistics. Keeping track of eighteen balloons that might go anywhere strongly suggested a widespread communications group. The Associated Radio Amateurs of Long Beach (ARALB) was challenged to the task and the wheels were set in motion. The Queen Mary W6RO, was the Net Control Station. W6RO is also the club station of the ARALB. Ron Boan AK6Y, the Emergency Coordinator of the Long Beach section of Los Angeles County, organized many volunteers to help with the tremendous number of tasks to be done. Since Mile Square Park in Orange County, an old Marine Corps Air Station, was chosen for the launch site for the 1980 race, the Orange County amateur radio clubs filled many of the positions as launch control checkpoints, net control operators, and observers.

This year, 1981, the race expanded under the leadership of Ron Boan, myself, and Joe Brown W6UBQ, SEC of Riverside and San Bernardino counties ARES groups. Two objectives were put to the test. The first objective, of course, was to provide communications for the race. The second was to handle the traffic, assign the personnel, etc., in the format of an ARES drill.

Mile Square Park was the starting point of the communications. Their assignment was to report via 145.52 simplex the actual time of launch of the balloons, or if there was a malfunction and delay, to report that also to net control. Since the balloons were to start launching at about 0900 on Saturday, April 25, everybody was in position and ready to start communications at 0600.

Some of the operators that helped at Mile Square Park on Saturday morning were: Al KA6IIJ, Glenn N6AFZ, Carol KA6JMW, Walt WB6RQT, Bob KE6C, Hector WB6WLB, Scott KE6B,

Launch-site communications for the Gordon Bennett International Cup Race were headed up by Ron AK6Y from his RV.

Next to the RV command center was the Orange County Sheriff's Department who maintained contact with the hams for emergency coordination.

The eventual winner, Benihana, from Japan. Each balloon used an individual launch pad.

Sandi WA6WZN, Herm K6TSM, and Jim W6PGM "manning" two meters.

Activity at the Orange County Communications Center.

Chuck KD6BX, Rosie WD6ERM, Jim KB6EX, John WA6HIJ, Chuck WB6ZAL, Dan WD6AWG, George N6AWF, Bob KA6CSS, Herb WB6USF, Paul N6DWR, Ken N6CCE, Bart W6CKT, Frank WB6JBV, Chuck WB6QKW, and Bob K6PHE. Ron AK6Y headed up the park operators from his RV. The various support groups, such as the Orange County Sheriff's Department, kept in constant touch with the hams in case of unexpected landings in the nearby area.

I might mention at this time that the Keller Peak Repeater, WB6FUB/R, which has a fantastic coverage of southern California, was turned over to the Balloon Race to provide the widespread communications link out of the park to net control and the observers. WB6FUB/R repeater is basically an ARES machine and its use provided an exercise in its coverage and the discipline of its users.

Net control, which interfaced Mile Square Park to the rest of the world, was located at the Orange County Communications Center located in the City of Orange, California, some 8 or 9 miles east of the Park. From this point, the launch information provided by the Park, such as balloon colors, markings, and headings, were transmitted through the repeater to the observers. They used both repeater frequencies of 146.985 and 223.80 MHz.

The hams manning net control over the weekend were: Don WB6GBW, Tom KA6MZN, Willis WB6WHT, Alex W6RE, Bob WA6SKE, Judi WB6SKE, Maggy KA6CVQ, Tom W6HT, Sherwood WD6CZE, Ed N6AEY, Fred K6KNC, Bill KB6HK, Judy KA6FBI, Gerald W6PCI, Frank KA6BUX, Bob KD6CF, Gordon W6SGI, Bob KD6DA, Rosemarie N6BCY, Mark KJ6H, Pat KA6ENG, Bob WB6FCP, Archie WD6CSL, Al KA6BNI, Lyle N6LB, Esther WA6UBU, and Bill W6TNR.

Since the balloons were intending to travel long distances, contact between our net control in Orange County and California's neighboring states was essential. The amateur radio station of K6RTR has a phenomenal "hot spot" for a straight shot to the Kingman, Arizona, repeater, WR7AEL. Del K6RTR, along with Ernie WA6FOW, Robin KA6HNY, and John KA6HRK provided this link to net control.

The prevailing winds across Orange County are marine onshore breezes from the Pacific Ocean toward the east. Since the balloons can be controlled only up and down, they are at the mercy of the wind direction. This means that the balloons must gain sufficient altitude in a relatively short distance to clear the tops of the Chino Hills and eventually the San Gabriel mountains. The San Gabriels reach 7,000 to 10,000 feet in certain locations. The chance that a balloon might not clear a hill or mountain made it mandatory that observers be stationed at the high points to watch for unscheduled landings.

Observers were stationed at strategic high points throughout Orange, Riverside, and San Bernardino counties. The following hams headed for the hills with their mobile units using portable beams, quads, or whatever it took to get into WB6FUB/R: Ted KB6IW, Jim WB6UIG, Oscar KA6GJI, Charlie WB6LKW, Roger WB6ARK, George W6LJK, Randy WA6WVJ, Sterling KD6Z, Jim WB6BZW, John KB6PT, Larry N6BNM, Dale WA0NKE/6, Gary WB6GCT, Clancy WA6HNQ, Lloyd WB6ULU, and Sid N6AQC. Fortunately, no balloons came down in the southern California area so no rescue operations were needed.

The winning balloon was the *Benihana* of Japan, traveling 1,346 miles to Millarton, North Dakota. Second was the US *Rosie O'Grady*, which landed 634 miles away in Myton, Utah. Third was another US balloon, *Ghost Rider*, landing in Nephi, Utah, 458 miles away.

Next year's Gordon Bennett balloon race will be on the weekend of April 24, 1982, and of course there will be hams and balloons once again.■

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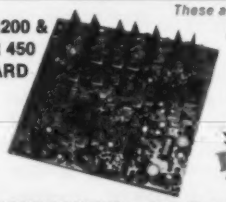

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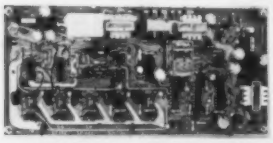

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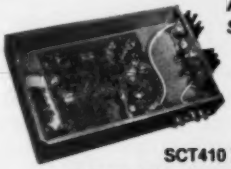

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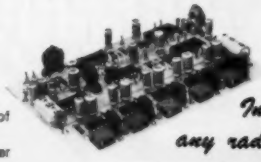

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Paul Grupp KA1LR
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The DS2050 KSR RTTY Terminal

—top performance at a bottom price from HAL

For those of us who have only become interested in RTTY and are looking for equipment, there are only three alternatives worthy of serious consideration. The first is to build the equipment yourself. Sure to earn you the admiration of your friends, building is time-consuming if you want your station to enjoy the sophistication that is now taken for granted in commercial RTTY products.

The second alternative is to buy a microcomputer, some software, and an interface designed to mate the computer with your ham equipment. The advantage to this approach is that you have a computer that will play games with you or even do serious work when you aren't on the air. The disadvantage is that such systems are still comparatively expensive.

The final alternative is a dedicated system that is designed specifically for RTTY. The dedicated terminals available now offer a high level of sophistication at a very reasonable price. You take one out of the box, plug it into the rig, and you are on the air. If the manufacturer provides a cable set for your rig, you can unpack the stuff and be done with your first contact in less than twenty minutes! The HAL DS2050, an excellent example of such a terminal, is the subject of this review.

For those really new to RTTY, a little history is in order. HAL has been producing the DS2000 terminal and the ST5000 demodulator for several years; the pair sold in such quantities that it seemed only logical to put them in a single enclosure. Since there was plenty of room in the DS2000 for another circuit board, the DS2050 KSR was born. At a list price of $649.00, it offers a lot of RTTY performance at a relatively low cost. What will it do? I thought you'd never ask!

The DS2050 KSR RTTY terminal.

The Features

The DS2050 is essentially a Z-80-based electronic data terminal and a RTTY demodulator in a single package. Transmit and receive text is displayed on a video monitor (available from HAL), so the various noises associated with mechanical RTTY are blissfully absent. The DS2050 is capable of communicating in three different modes—Morse, Baudot, and ASCII. It will transmit Morse at speeds from one to 175 wpm (Morse at one wpm is good for a couple of laughs!). Baudot is supported at your choice of five speeds, 60, 66, 75, 100, and 132 wpm, and ASCII will zip along at either 110 or 300 baud. Morse also can be decoded and displayed on the screen if the Morse-receive option is installed.

The DS2050 was designed with convenience in

Continued on page 120

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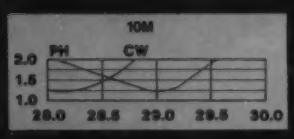

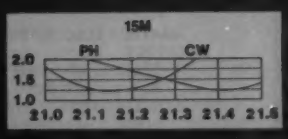

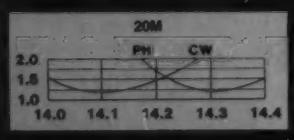

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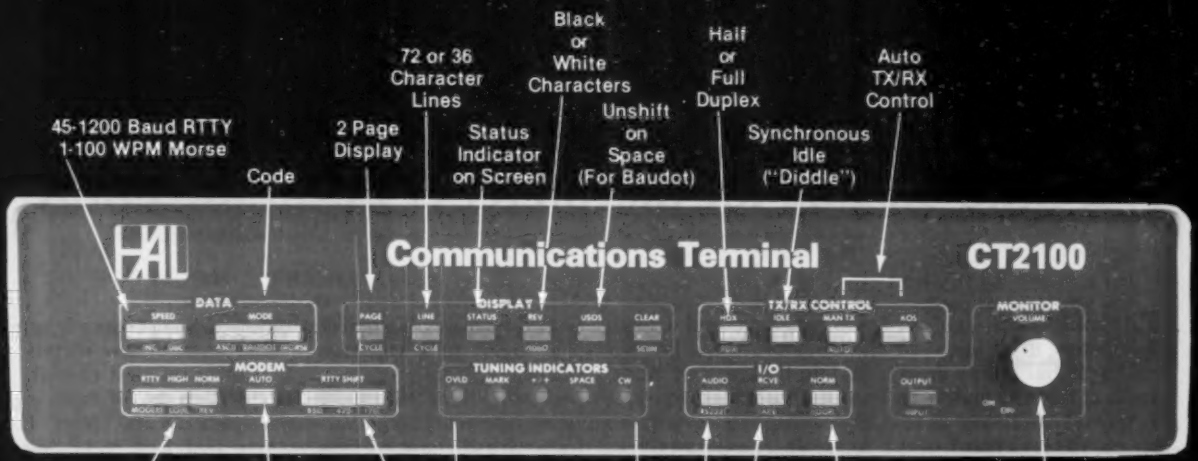

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73 Magazine Staff

The Welz SP-300 Swr and Power Meter

—a little digging for this meter is worth the effort

Behold, there are swr meters thick upon on the Earth, but a truly great one is as rare and elusive as a camel without bad breath. So says a ham friend of mine from SU-land, and, you know, he's right! There must be at least a thousand different swr meters available, but of all these, I can count the ones which do everything well on the fingers of one hand.

It seems that there are two basic varieties of swr meters. The most common is the box with a two-position switch marked forward and reflected, and a sensitivity control. You flip your rig into the transmit mode, set the switch to forward, and adjust the control to full-scale. Flip the switch to reflected, and you can read swr directly. Neat, except that the thing is only good for relative measurement of power output.

I can think of several situations in which I need to measure absolute power output, and for this, I need a meter with a calibrated scale. Such meters have the same switch as the first example, but they dispense with the sensitivity control. The meter tells you how many Watts are going out, and how many Watts are being reflected. Theoretically, you still have the little chart that came with the meter, so you look up the two values and, bingo, you know what the swr is.

This method gets old fast when you are using the meter to set an antenna tuner, particularly when using a solid-state transmitter, since output of these varies with swr. You will be misled unless you look up the swr on the stupid chart every time you adjust something.

There are a few meters that offer the best of both worlds, and one of these is the Welz SP-300. Now, I won't feel bad if you've never heard of Welz, since their products haven't been available in the US until recently. The Welz meters enjoy a sterling reputation in Europe and Japan, but the only US distributor that I know of is NCG Company of Anaheim, California.

Welz offers a wide variety of meters, and the SP-300 that NCG imports is their best model. As you can see in the photograph, it doesn't look that much different from any other meter, but don't let that fool you. This meter is first cabin all the way. The first hint I got of its quality was when I pushed the buttons and rotated one of the pots. I'd forgotten how good expensive controls feel! The all-metal construction gives the meter a satisfying heft, which, aside from feeling good, keeps it from disappearing over the back of the table, as lightweight meters in my shack are wont to do.

I popped off the cover and was rewarded with a view of a lot of serious shielding—the meter, swr

The Welz SP-300 power and swr meter.

Continued on page 146

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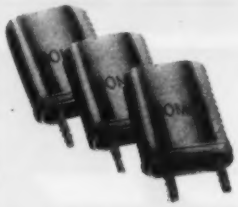

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D-10	10	16	22.95	18.95
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↙See List of Advertisers on page 114

Robert C. Diefenbach WD4NEK
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Free PR for Ham Radio!

—how to cooperate with the news media

We hams do a lot of good for our communities. All too frequently, though, people don't hear about our deeds. Whether through modesty, apathy, or simply from not knowing how to avoid it, hams' civic contributions are often anonymous. That is unfortunate at best and, considering the fact that our regulated hobby needs all the help it can get, probably foolhardy to boot.

We need more favorable publicity to impress the public with the positive impact of amateurs' public service efforts. The few negative impressions ham operators have made, largely unintentional through TVI and antenna squabbles, will fade to an appropriately insignificant proportion if the hobby begins to get more of the "good press" it deserves.

The ladies and gentlemen of the print and electronic media have an immense ability to focus public attention, but the news business is as competitive as pro football; it is a fact of life that reporting bad news usually scores more points than reporting good deeds. Editors, whose very jobs depend on the numbers of readers/listeners/viewers they attract and retain, will not ignore that fact without a good, businesslike reason. Listen up, gang, while I give you one.

The most hard-nosed editor will pay attention when you offer *free* expansion of his or her coverage of news events. Generally, the editor will be happy to reciprocate with just the kind of printed or broadcast publicity that ham radio wants and needs.

It works this way. When your ham group agrees to provide communications for a newsworthy event, invite the press to monitor your operation and to use what they hear as a part of their news coverage. I am referring to events planned in advance, not to emergency communications—except under controlled circumstances described later.

Now don't jump up on your soapbox and say "That's not legal!" According to what I have been told by an FCC official who should know, it *is* legal if you take a few simple steps in advance.

Amateur radio transmissions are protected as "private" by federal law despite the obvious vulnerability of that privacy to anyone with a receiver capable of tuning the ham bands. Under Section 605 of the Communications

John Snellen WD4FBC monitors operational frequency during an event and shares information with WTBS control room crew. Photo by Susan DeShazo, courtesy of WTBS Superstation, Atlanta.

Act, anyone violating that privacy by intercepting and divulging the content of a QSO could earn a criminal penalty of up to $10,000 and one year's imprisonment. Despite the long odds against being found out and prosecuted for eavesdropping, a news service would be crazy to risk even the possibility of running afoul of that law, by, say, repeating information picked up from a synthesized scanner in the newsroom.

It is nice to know that our transmissions are protected. But, for the purposes of getting publicity, it is also nice to know that we can shed that protection and openly urge the press to monitor our QSOs and use whatever they find newsworthy.

All that is necessary, according to FCC Associate General Counsel Lewis J. Paper, is for the hams to *agree in advance* to having their transmissions intercepted and their contents divulged.

Counselor Paper has confirmed, in an exchange of correspondence with me, that if amateurs give their permission in advance, the media or others can freely eavesdrop and make use of what they hear. This does not mean that radio or television stations can rebroadcast amateur transmissions as they happen, or live. That is banned by regulations governing commercial licensees. But insofar as use of the data contained in the ham transmissions is concerned, prior approval of the hams is all that is needed to avoid privacy violations under Section 605.

How do amateurs "give their prior approval" in a way which satisfies the rules? No clearcut way is given, but obviously it is best to use a method which can prove, if a challenge is ever made, that their permission to intercept was given *before* interception of their transmissions. When recruiting communicators for planned events like marathons, water events, or parades, it is a simple matter to make each operator's approval a condition of his or her participation. A clear caveat to that effect can be included in whatever recruiting messages you put into the mails or on the air and any communications plan you publish for the event.

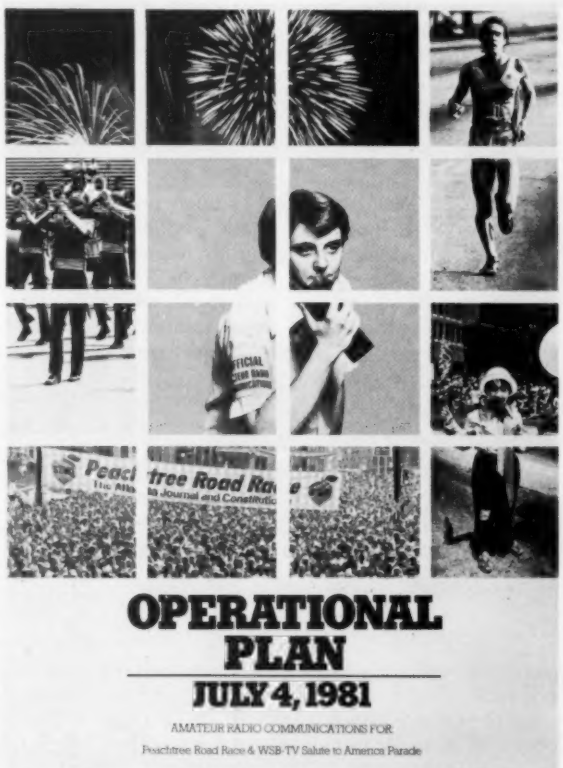
I realize that the communications which might attract the most media attention, and thus the most publicity for amateur radio, are those involved with emergency situations. But under most emergency operating conditions, asking and getting each communicator's permission for interception/divulgence could take so much time that the entire operation might be endangered. For that reason I would advise that amateurs not invite press coverage of their emergency communications except in cases of tightly organized and controlled local nets where all members have given blanket authorization for interception of transmissions whenever the net is called into session. Coordinators of local emergency nets whose members have agreed to being monitored can notify the media as an automatic part of calling up their nets for actual emergencies.

Just inviting the press to legally eavesdrop during amateur public service efforts is no guarantee they will accept the invitation. Even if they do, there is no assurance that hams will get the favorable credit they would like for material the media overhears and uses. Reaching that goal will take planning, sales ability, tact, and realistic caution. Here are some points to keep in mind:

● *Don't waste time.* Your time and that of your media contacts is too valuable to waste by suggesting that they monitor any amateur operation that common sense tells you couldn't interest them less. Before approaching an editor, make an effort to learn his or her organization's news interests. The organizers of the event you are working on probably will know from previous experience which media will cover it and can suggest those which might find it helpful to monitor your communications.

● *No time for shyness.* You cannot be shy or overly modest about asking the press to "plug" ham radio. Print space and broadcast time are for sale. The media rarely volunteer to give either away but, for a reason as good as yours—free expansion of media coverage—will usually be receptive to the idea when asked. You may find yourself the subject of a "sidebar" interview during a break in the activity reporters are covering. Be prepared, but be brief. The more you and your media contacts credit amateur radio overall rather than your ham club or group by name, the bigger the service you will be doing for your hobby.

● *Beware overselling.* Be honest. Tell editors accurately what their reporters can expect to hear if they monitor your operations. Don't try to sell the idea that only reports of serious traffic tie-ups will be heard on 146.82 MHz between seven and nine am when you know there will be rag chewing, too. The



This is the cover of the 16-page *booklet that covers the monumental Peachtree Road Race and Fourth of July festivities. It provides in great detail the information required to successfully manage an event of this size.*

Gene McCall WA4OAU, on board camera truck just ahead of the leaders in the Avon Atlanta Women's 10-km race, reports early changes in the lead.

WGST Newsradio sports reporter Steve Holman (in car) does an "on-the-scene" broadcast using information relayed by Gene Davenport N4AJL. Photo by Barry Milberg WD4DAA.

newsroom scanners will be programmed off that frequency, probably never to return, after the first minute's chitchat about swr or the next club meeting.

● *Be accommodating.* Chances are that only a few of the news organizations you approach will have receivers capable of monitoring amateur transmissions. You can accommodate those which don't by assigning hams to make their equipment available during the operation, wherever the editors ask. You should be prepared to provide this service at the scene of the event, in vehicles of any sort, and in newsrooms or studios.

Amateurs assigned this responsibility should be reminded that the news organization's business is collecting and reporting facts, and that messages on its behalf would thus have monetary value. Such messages are taboo. Even a simple request for another ham to repeat a missed message or to check a name could place *the amateur* in violation of FCC regulations.

Earphones are a must for operators assigned to radio or TV reporters who may need to go on the air themselves. Their stations don't want (and legally shouldn't have) background sound of ham transmissions rebroadcast on their own frequencies.

● *Caution: Don't accept payment.* Hams as individuals, in clubs, or in other groups should remember that accepting payment of any kind for allowing the press to intercept and divulge their transmissions could result in suspension or loss of their licenses.

● *Think before transmitting.* Hams are morally, if not legally, responsible for the effect upon others of information which they transmit. When the press is known to be monitoring and to be free to use overheard information, the level of a hams' responsibility increases dramatically. A thoughtless transmission, possibly occasioned by overeagerness to please the media, could have unexpected and perhaps harmful results. The name of an accident victim or a guessed-at but false diagnosis could easily be reported on newscasts before the data are confirmed or families are contacted. If potentially alarming messages must be sent, hams should clearly state their source of information. "Officer J. D. Smith, badge number 1234, has talked with the doctor. Officer Smith says . . ." The ham would be wise to make a written record of the officer's name and badge number, just in case.

● *You can withdraw consent to monitor, but . . .* The amateur group's permission for the press to intercept and divulge transmissions can be withdrawn at any time—even during an operation if something urgent makes it necessary. A need could arise, for example, to transmit medical or security messages which should be kept as confidential as possible. Such messages, before their content is revealed, should be clearly identified as private and not intended to be divulged. But think twice before withdrawing the very permission you have gone to some effort to give and exploit. When there is a story in the wind, trying to keep the press away from it can be a *very* unpleasant experience. Your whole press relations program could explode in your face. Most aggressive reporters will ignore the prohibition against divulgence, anyway, figuring that this is a problem for the lawyers, not for them!

● *Explain. Don't threaten.* Early on, and for two reasons, editors, and reporters should be made aware of the privacy provisions of Section 605. Hopefully, they will be impressed with your group taking the initiative to help them expand

POSITIVE PUBLICITY

The author organizes communications in Atlanta, Georgia, for events like the huge (over 25,000 runners!) Peachtree Road Race. Thirty ham operators used two-meter equipment to work the annual Fourth of July race this year. They provided logistic, course, and medical communications.

Following the guidelines spelled out in this article, the Atlanta hams gained excellent national publicity for the hobby by allowing their QSOs to be monitored by commercial broadcasters, including the "Superstation," WTBS-TV. The race—and a lot of nice credit for amateur radio—was telecast into an unbelieveable 15,560,000 homes via satellite and cable. Viewers in all 50 states and Puerto Rico, more than had ever seen a road race before, saw The Peachtree and learned that ham radio played a major role in making it happen.

pand their coverage of whatever event you are supporting by allowing interception and divulgence of transmissions, and they also should be impressed with (but not scared off by) the fact that this is a privilege rather than a right, given for a specific time and purpose. At the risk of boring them with what many may consider bureaucratic trivia, you should be certain that the press understands that this privilege can be immediately cancelled at the amateurs' discretion and that there would be criminal penalties associated with willful violation of the hams' thus-reinstated privacy. A thorough, non-threatening explanation up front could prevent embarrassment or worse if something unforeseen comes up later.

This article deals with an interpretation of the regulations, and I must point out that I am not an attorney and am not intending to give legal advice to readers. I have no doubts at all, personally, however, that my correspondence with the Commission's associate general counsel confirms that hams can use this method to legally solicit publicity for the hobby. Based on Mr. Paper's letters, I intend to include cooperation with the press as an integral part of any ham communications effort I am asked to organize.

The FCC may have something to say about amateurs going after favorable publicity so aggressively, although to disagree with hams' right to do so would seem to dispute the Commission's own legal interpretation as stated by their associate general counsel. If any such dispute arises, I suspect that you will read about it right here in *73 Magazine*.■

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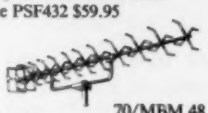

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Tricking-Out the FT-901/902

—some competition mods from the Fox-Tango racing team

In the almost ten years that Milt Lowens has served as editor of the *Fox-Tango Club Newsletter*—at the beginning of which time he founded the International Fox-Tango Club for Yaesu equipment owners—literally thousands of suggestions for improving Yaesu rigs have crossed his desk. Among the best in terms of simplicity and effectiveness was one first written in abbreviated form by Harold Johnson for the November, 1980, issue of the *Newsletter.*

The first part of the following article is that 1980 piece essentially as written, but with some italicized parenthetic comments by Milton Lowens. The second part (written by Milt) gives generously illustrated instructions which should enable even a comparative neophyte to do the job. No irreversible changes are involved, no drilling or panel changes are needed, and no wiring changes are required except on one, easily unplugged, circuit board. Considering the reported effects of this modification and his own experience with it in his FT-901D, it is no wonder Milt rates it as a "winner"!

Part I: Significantly Improving the FT-901/902 Receiver

In a continuing search for a replacement for my 20-year-old KWM-2 receiver, I have either purchased or borrowed almost every "new" radio that has come down the pike. It is a sad commentary on the state of the art that, despite fringe bells, whistles, and cosmetic changes, nothing I can find on the market has measured up to the 25-year-old design, at least in the receiver department. In the final analysis, I have been forced to the conclusion that, because of deficiencies in various parameters, the present solid-state radios cannot copy signals that are still solid on the KWM-2.

Of several makes and models owned and evaluated, the Yaesu FT-901DM [*and now the 902 with all the WARC bands and other improvements, including an excellent new true-reading digital display*] came closest to measuring up to the very stringent standards I had set. Besides, its bells and whistles included the 160-meter band, all of ten meters, FM, AM, and FSK operating modes in addition to the standard SSB and CW, memories galore, RIT tuning for RX, TX, or both, built in ac and dc supplies, true rf speech processing, an automatic Curtis keyer, true variable passband and rejection notch tuning, and a very fine audio peak filter (to mention a few!).

After the first blush of ownership pride, however, one major problem with this competition grade radio (as Yaesu calls it) was a total lack of ability to compete in the receiving department. In the presence of strong signals outside the receiver passband, readability of weak signals was degraded by reciprocal mixing and agc pumping. The radio actually was in my operating position three times and each time was replaced with "old grandad." The last time, I fully intended to get rid of it as another lost cause when I decided to try to cure the shortcomings since the fringe benefits were so great. Measurements taken on the radio prior to attempting surgery revealed an ultimate rejection of only 55 dB, and I began to realize that there was a task of some magnitude ahead if I were to effect a "cure."

It was assumed initially that there must be some leakage around the existing selectivity circuits in the radio, and the search for the path was on. Since the crystal filter was diode-switched, there was the possibility of inadequate bypassing and feed-around

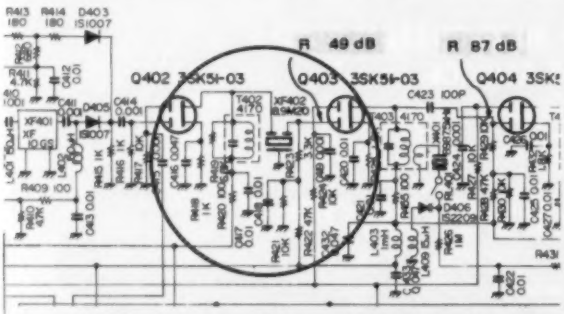

Fig. 1. Partial schematic of i-f board PB-1704 showing original connections of XF402 and related components.

occurring via the dc control lines. Twenty dollars worth of glass 0.1-μF caps at strategic spots on the filter board later, showed a total improvement of 0.

Reading of similar problems plaguing the TS-820 where the problem was in the noise-blanker circuitry, C225 on the noise-blanker board of the 901 was removed. This certainly opened the noise-blanker path but improved the ultimate rejection by not quite 1 dB. Hardly a dramatic improvement! Then noting that the i-f was passed around the filter in the FM mode, here was another possibility; diode D310 on the filter board was removed. Alas, life was not to be so easy. This simple cure netted only another 1.5 dB of improvement. Obviously, the engineers at Yaesu had cleaned up these paths right well! After all this I could see only two other possibilities: I figured I might as well tackle the cheapest one first.

That was the chance of cross-coupling in the common cabling under the pluggable board sockets. The filter board was pulled; the jumpers bypassing the optional (but not installed) CW filter were removed [*thus opening the i-f chain*]. Upon re-installation of the filter board, no difference could be determined between power on and power off in the CW mode. The radio was dead with 100,000 microvolts at the input. That experiment satisfied me that the ultimate rejection was really a function of the factory-installed filter; it just flattened out for me at −55 dB. Unfortunately, there are still lots of countries on the air that I need that are represented by signals lots weaker than 55 dB down from some of the W2s heard at the QTH.

A custom filter of at least 12 poles that would mechanically fit the filter board was a bit rich for my blood (about half the price of the radio), so an equivalent of the existing filter was ordered from the Fox-Tango Corporation for something less than $60.00. Although there was some delay at the time, this excellent filter is now available from stock. (See Parts List.) The filter was installed with diode switching at the input to the balanced modulator—after the i-f gain, as suggested by Sabin and Hayward. Skirt selectivity improvement was noticed, but since the agc amplifier is fed from a point ahead of the second filter, agc pumping from strong adjacent signals was still present and tended to mask or distort weak signal reception.

So I tried another approach (no one can accuse me of not being persistent, hi!). To obtain the band-pass-tuning feature, Yaesu up-down converts the 9-MHz i-f to 10.8 MHz with filtering at each frequency to permit a variable-width window of common passbands. This feature, first advanced by Bill Orr in the 50s, works superbly since using a common oscillator results in passband tuning with zero tracking error. After the dual-heterodyning process, a modest filter is required to rid the radio of mixing products. An extremely simple two-pole crystal monolithic filter, XF402, was utilized for this purpose (by Yaesu). See Fig. 1. While it cleans up these spurious products nicely, the filter is so elementary that it provides no help at all in enhancing the skirts of the main filter (XF302, 3, or 4).

Despite a disparity in impedance levels, filter XF402 was removed from the i-f board, the switching diodes and filtering on the added filter were removed, terminating resistors were changed, and the new filter was patched in in place of XF402. No attempt was made to add gain to the i-f amplifier to compensate for the insertion loss of the new multi-pole filter. [*Subsequently, Harold did devise a simple method for adding gain; it is described below.*]

The unconverted radio has an i-f gain such that a .7-microvolt signal gives 10-dB signal-to-signal + noise, and the MDS figure remains unchanged with the additional filter installed. I have cascaded filters in my KWM-2 and several "S" lines with spectacular results. Addition of this second filter to the FT-901DM [*and probably to the 902*] is no less startling. It turns this "competition grade" radio into a real contender.

In performing this surgery on two different radios (4 filters), the filters seem extremely well matched for center frequency with practically no effect on the "nose." The skirts, however, take a real nose dive. Ultimate rejection is beyond my ability to measure (in excess of 100 dB) and the agc system just doesn't respond to anything that isn't in the passband.

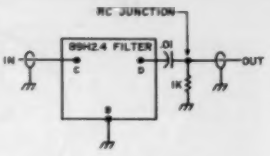

Fig. 2. Connections to new 8-pole filter YF89H2.4.

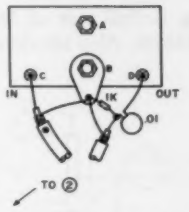

Fig. 3. Pictorial showing connections to new 8-pole filter YF89H2.4.

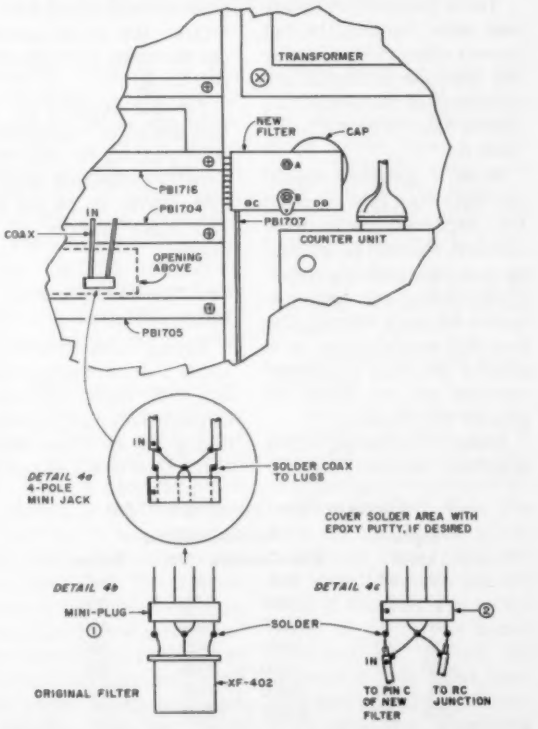

Fig. 4. Pictorial showing placement of new filter and its related connectors and cables.

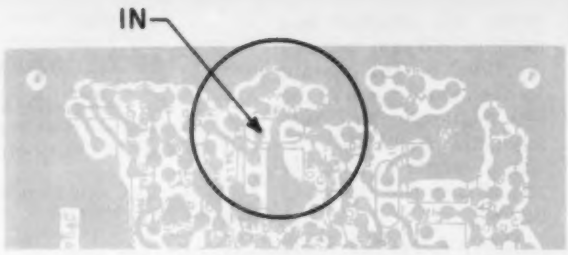

Fig. 5. Foil side of PB-1704 with detail showing required changes. Also see detail 8c.

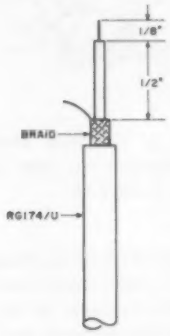

Fig. 6. Preparing the ends of RG-174/U coax for connection to PB-1704.

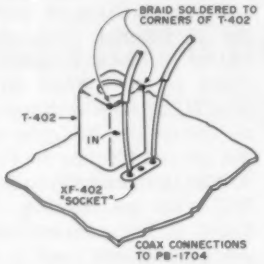

Fig. 7. Detail showing method of connecting coax to PB-1704.

Table 1 details the before and after bandwidths but cannot adequately describe the increase in depth and steepness of the skirts. You almost have to hear it to believe it.

Now, if someone would just figure out how to make the *backward* radio tune forward, I would be as happy as a clam with my "new" FT-901DM! [*Too bad you were a bit early, Harold. The new 902 model tunes, as it should, so that clockwise rotation of the knob increases the frequency.*]

Many Fox-Tango Club members besides the authors have tried this filter-cascading modification and have found it relatively easy to make and very effective. We would appreciate receiving your reports if you try it.

For the purpose of "before and after" comparison, tune your rig for maximum S-meter deflection with the CAL signal at 14,200 kHz and make a note of the reading.

Test Conditions and Instrumentation

Set-up conditions for Table 1 were Hewlett-Packard 608 signal generator through 5-dB pad, passband tuning at 0, USB mode, notch filter out, and agc off.

Effects of Filter Cascading in FT-901

Signal Level		Bandwidth in Hz With Cascade Filter		Reduction
uV	dB	Out	In	
1	−6	2400	2050	350
10	−20	2500	2100	400
100	−40	2800	2400	400
1000	−60	3400	2600	800
10k	−80	12400	4200	8200
100k	−100	33000	15800	*

*Reciprocal mixing at this signal level.

Table 1.

Part II: FT-901/902 Filter Cascading

Harold mentioned two problems in the first part of this article which troubled me a bit: the impedance mismatch when inserting the new filter and the resulting losses. Even though neither of these had a significant effect in terms of day-to-day operations because of the inherent sensitivity of the 901, I realized that some purists might be unhappy. However, before I could even write Harold about the insertion loss problem, he solved it in a simple and ingenious way by changing the location of the output coupling 1k resistor so as to load down and slightly change the bias on the next stage, Q403. This increased its gain just enough to offset the filter insertion losses almost exactly. (See Fig. 2.)

The matter of improving the impedance matching seemed like a more difficult problem until a fortunate discovery was made. Fig. 1 shows pertinent portions of the original circuitry of PB-1704C, the i-f board. The basic idea of the modification was to remove XF402 (between Q402 and Q403) and to substitute the 8-pole, 2.4-kHz bandwidth Fox-Tango filter for it. Note that the input end of the original filter is attached to the upper end of the coil in T402 which, with its shunting capacitor, looks more like a simple resonant circuit than a transformer. *If it's a transformer, where is the secondary winding?* All the other "T's" had them! Maybe T402 did too! A study of the parts list in the service manual vindicated my hunch: T402 *and* T403 had identical part numbers and a step-down secondary winding—ideal for impedance-matching the new filter! I could hardly wait to examine the back of PB-1704C in the vicinity of T402 since the parts layout diagram (Fig. 5) showed what looked like a transformer pin not connected to anything.

Eureka! I had found the solution. A few checks with the ohmmeter confirmed the presence of the winding with one end grounded, just like T403. Prior to this discovery, I had made the modification in my own FT-901D and was pleased with its results. However, upon making the simple change to utilize the newly-found secondary winding, the maximum CAL signal indication increased several dB! Talk about gilding the lily—I was delighted since the selectivity also seemed even better than before. So the following detailed instructions include the use of T402's "invisible" secondary. (See Fig. 8.)

One thing more. As originally proposed, W4ZCB's mod eliminates the possibility of AM/FM operation, a serious loss since the FM, at least, is a very desirable feature in the FT-901DM and D models (even though the DE and SD models do not have it, and for them the first design was fine—except for that secret secondary). This problem was solved by, in effect, providing a "socket" at the end of coax leads connected to the points on the board to which the original 2-pole filter was soldered.

This new socket terminated under a small removable lid in the top of the cabinet so that, by using matching miniature plugs, either the original 20-kHz filter (very small) or the new 2.4-kHz filter (at the end of another short length of coax) could readily be plugged in when desired. Further, for special purposes, *any* filter could be plugged in at this point temporarily while resting on top of the cabinet as long as a mating plug was connected to it.

They say that one picture

is worth a thousand words, and there are lots of pictures so I'll try to keep the words to a minimum. Anyway, start by comparing Figs. 1 and 8 carefully, noting the differences. Then become familiar with the others—especially the details. Next, take off the top cover of the cabinet (don't be afraid) and remove the black plastic panel at the left, over the circuit board compartments. Using the markings on this panel, locate PB-1704, remove the two screws at the ends of its hold-down strap, and using a knife blade or thin screwdriver, wedge up first one end of the strap and then the other, a bit at a time, until the board comes out of its socket. Examine the board carefully, noting the location of XF402, T402, and R419. All components have their identifications printed on the board, and the photographs in your owner's manual will help further to identify the key components.

Turn the board over and note that a portion of the foil side is covered by a metal shield which makes it difficult to see or gain access to the three soldered connections of XF402. Using long-nose or small ignition pliers, bend up the obstructing corner of the shield temporarily and you are ready to begin. Practically all the work is done right on PB-1704, no wiring is changed under the chassis, and no changes are irreversible. So heat up your light-duty, fine-tipped soldering iron, clean and tin its point, and go to work.

Detailed Procedure

A. Modifying PB-1704.

1. Clearly identify the three soldered connections of XF402. (See Fig. 5.) Unlike a crystal (which it resembles), it is not plugged into a socket—it is soldered to the board. Its three leads are thin and usually bent over before soldering. Carefully remove the solder from the three points using de-soldering wicking or suction. Straighten the leads so that when the solder is removed, XF402 can be lifted from the board without using any force.

2. Study Detail 8c and locate the short trace (foil strip) which must be cut with a hobby knife or sharp blade. Use a strong light since the trace may be hard to see under the green varnish-like solder-resist which covers all of the board except the solder points. Use your ohmmeter to be sure the trace is actually cut.

3. Locate blank pin (S) of T402 and solder a short, thin, insulated jumper wire to it. Note that it connects to the IN connection of XF402, but do not solder it there until the coax is inserted. See Fig. 7.

4. Prepare both ends of the RG-174/U coax as shown in Fig. 6. Tin the exposed ends of the center conductor and insert them as shown in Fig. 7. Solder them to the foil side (as the filter was previously). Now connect the jumper wire from pin S. Next tin the upper corners of T402 and solder the braid tails to them for grounding and strain relief. Hold the braid tail with long-nose pliers to act as a heat sink to prevent melting the plastic insulation of the coax.

5. Optional: Locate R419 adjacent to the right side of T402. Since its solder points are blocked by the shield on the foil side, cut the resistor lead as shown in Detail 8a. The cut ends can be re-soldered if ever desired.

6. This completes the work on the board. After bending the shield back to its original position, more or less, re-install it in its socket temporarily and bring the coax loop toward the front panel. Drop the black plastic panel into place after slipping the coax through the large rectangular opening in the black panel. Cut the coax at the front end of the opening. (See Fig. 4.) It is important to identify the IN lead with a bit of white tape, paint, etc. Once again, take off the plastic panel and remove PB-1704 to simplify making the connections shown in Detail 4a.

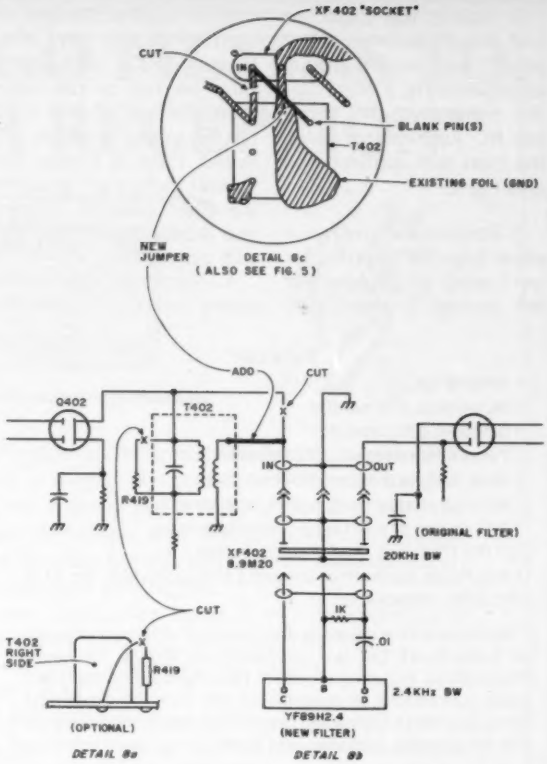

Fig. 8. Revised schematic showing essential changes involved in the modification (compare with Fig. 1).

B. Connecting the connectors.

1. Detail 4a shows a mini-jack; B and C are matching plugs. Though only three pins are needed, the four-pin type is used to make soldering of the braid tails easier and to help separate the input and output connections. The illustrations are practically self-explanatory; just expose no more of the unshielded center conductor than is necessary; tin the solder points and work carefully. The two inner lugs of the connectors are bent towards one another. A third hand to hold the connectors during soldering will make the work much easier. Use a light touch with the iron and work quickly. The leads in Detail 4c will be connected to the new eight-pole filter.

2. Re-install PB-1704, including its hold-down screws.

C. Installing the new eight-pole filter.

1. See Fig. 4. Mount the ground lug on filter stud B using the nut and star washer unless one is stamped into the lug itself. Rest the filter on top of the black cylindrical filter capacitor and slide it towards the left until it touches the metal shield of the circuit board compartment. It will be secured at this point later with special copper double-stick tape (for grounding the filter case) called a "Mount-It."

2. Solder the capacitor and resistor between filter post D and the ground lug as shown in Fig. 3. Note that the common point forms the RC junction to which the coax will connect. See also Fig. 2.

3. Remove the protective paper from the Mount-It (or use foam-type double-stick 3M mounting tape) and press it against the end of the filter nearest pin C (IN). Repeat step 1, resting the filter on top of the large capacitor and sliding it to the left until it contacts the shield. Press it firmly; the special adhesive grounds the filter case (if copper) and bonds more strongly with time.

4. Remount the black plastic panel and tighten its six hold-down screws. Bring the coax with connector 4a up through the rectangular hole. Mark the IN end with paint, brush pen, etc. Do the same for the end of the 4C connector to be chosen as IN. The two must always be connected so that the IN marks match. 4B can be connected either way. The area where the connectors and cables are joined can be covered with epoxy putty to make a neater and more secure job. Try plugging 4B into 4A. Then try 4C; its leads are longer than necessary to reach the eight-pole filter. Cut them to a suitable length with a bit of slack; bare the ends and connect as shown in Fig. 3.

5. This completes the modification. Note that the XF402 assembly (Detail 4b) can be secured to the black plastic panel at a convenient point with double-stick tape; the same is true of connector 4C. Thus, connector 4A (which is loose) can be shifted readily from one to the other. Turn on the set and test its operation. The S-meter deflection should be about the same as before or perhaps a bit greater. Adjusting the slug of T402 might improve matters a bit more, but since an extender board would be needed, it is usually not worth the expense and trouble. If desired, adjust VR401 on PB-1704 to get the original S-meter reading with the CAL signal.

6. Close the cabinet by remounting the top cover and test the connectors for accessibility by removing the small access lid. Connector A makes it possible to experiment with other filters in the future without removing the top of the cabinet. Just duplicate the 4c and Fig. 3 assembly, using clips at the filter end, if desired. ■

Parts List

1 Ground lug
1 1k 1/4-Watt, 5% resistor
1 0.01 50-V disc capacitor
1 Female four-contact mini-connector*
2 Male four-pin matching connectors*
1 Mount-It (copper double-stick tape assembly)
1 3/4" square of double-stick foam-type tape
12" RG-174/U high quality coaxial cable
1 Fox-Tango 8-pole filter (2.4 or 2.1 kHz bandwidth; No. 2110 and 2009, respectively).

*Mini-connectors are made from sections of 36-contact header strips by AP Co., Nos. 929834-01 and 929974. The above Parts Kit 4J, including choice of filter bandwidths and complete instructions, is available for $60 from the Fox-Tango Club, Box 15944, West Palm Beach FL 33406. Airmail postpaid US and Canada. Overseas, add $5.00.

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The greater the number of poles in the IF filter of a receiver, the greater its selectivity and freedom from adjacent channel **QRM**. Most manufacturers of modern sets provide SSB filters as standard equipment and offer 6-pole filters as extra cost options. A simple way to improve all such sets is to add an additional 8-pole **SSB** filter in cascade (series) with the existing filter, thus providing up to **16** poles of filtering in **both SSB** and **CW**. Even better, if the new filter has a slightly narrower bandwidth than the original, selectivity and ultimate rejection are improved even further.

The following magazine articles all feature the use of superior **Fox-Tango** filters for cascading, and stress the simplicity of their installation which requires no drilling or additional switching:

CQ—March 1981. Tighter Skirts for the **Kenwood** TS820. (Applies also to TS520.)

Ham Radio—April 1981. Improving the **Heath** SB-104A.

73—Sept. 1981. Filter Cascading in the **Yaesu** FT-901/902. "Tricking out the FT-901/902"

FOX-TANGO not only stocks the filters recommended in the above articles but also provides detailed instructions and kits of additional parts or cascading boards if needed. Send a large SASE (or $1) for details; specify the modification you want.

ALL Fox-Tango filters are 8-pole high-quality units made from specially treated high-Q discrete crystals. They are custom made for drop-in installation on existing boards or replacement of existing units, matching perfectly both physically and electronically. No expense or effort has been spared to make Fox-Tango the BEST filters available. Don't be fooled: cheap substitutes are no bargain! The following bandwidths (Hz) are available for the sets indicated; most still cost only $55 airmail postpaid (US & Canada; elsewhere add $5).

YAESU—All popular HF models: 250, 500, 1800, 2100, 2400, 6000.

KENWOOD—R599, TS520, R820, TS820, and similar: 250, 400, 1800, 2100.

HEATH—All popular HF models: 250, 400, 1800, 2100.

DRAKE—R-4C & R7/TR7: 125, 400, 500, 600, 800, 2100, 2400, 6000, 8000.

COLLINS—75S-3B/C: 250.

Since not every bandwidth is available for every model, write or phone for free information or brochure. We accept mail or phone orders; payment by VISA/MASTERCARD. Money Order, Check, COD (at your expense). Order with confidence—All Fox-Tango Filters are guaranteed for one year.

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See List of Advertisers on page 114

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Model TE-292
$125.95

Features:
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- Choice of Message Storage
  - A. Six 50 character messages
  - B. Twelve 25 character messages
  - C. 27 combinations of message C. programming.
- Records at any speed—plays at any speed.
- Memory operating LED
- Use for daily QSO or contests

PLUS:
- Self-completing dots and dashes
- Both dot and dash memory
- Iambic Keying with any squeeze paddle
- 5-50 w.p.m.
- Speed, volume, tone, tune and weight controls
- Sidetone and speaker
- Low current drain CMOS battery operation—portable
- Rear panel Jack for auxiliary power
- Deluxe quarter-inch jacks for keying and output
- Keys grid block and solid rigs
- WIRED AND TESTED FULLY GUARANTEED—LESS BATTERY

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Features: **Model TE-284**
- State-of-the-Art CMOS Circuitry
- Three choices of Message Storage
  - A. Two (50 character each) message storage
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  - C. One 50 character and two 25 character message storage
- Records at any speed-plays at any speed
- Memory operating LED
- Use for daily QSO or contests

PLUS:
- Self-completing dots and dashes
- Both dot and dash memory
- Iambic Keying with any squeeze paddle
- 5-50 w.p.m.
- Speed, volume, tone, tune and weight controls
- Sidetone and speaker
- Low current drain CMOS battery operation—portable
- Deluxe quarter-inch jacks for keying and output
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Features:
- Advanced CMOS message memory
- Two (50 char. each) message storage
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- Records at any speed—plays back at any speed
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PLUS:
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- Self completing dots and dashes
- Both dot and dash memory
- Iambic keying with any squeeze paddle
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- Speed, volume, tone, tune and weight controls
- Sidetone and speaker
- Low current drain CMOS battery operation—portable
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- WIRED AND TESTED FULLY GUARANTEED—LESS BATTERY

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- IAMBIC keying with any squeeze paddle 5-50 wpm
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- Keys grid block and solid state rigs
- Wired and tested—fully guaranteed—less battery

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MODEL TE122 – same as TE133 less wgt, tune, solid state keying **$39.95**

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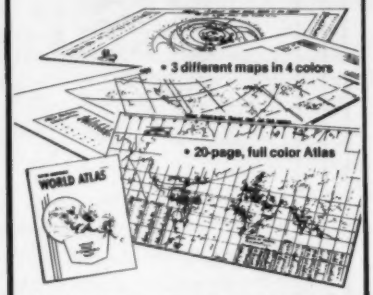

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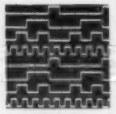
Convert your single channel scope into a 4 or 8 channel instrument; just connect the DM-12, 8 channel scope multiplexer to your scope, clip the 8 input probes to the signals you want to view. Simple, easy, fast — can handle logic level TTL signals from DC to 3MHz. Features separate spacing and trace amplitude controls and selectable sampling rate — all to insure easy clear scope display.

Completely assembled and tested! Ready to use!



VIEW 8 CHANNELS AT ONCE!

- 8 TTL compatible input channels (1 TTL load per channel) can drive 50 Ohm scope cable.
- Maximum full screen amplitude 1.6 Volts adjustable.
- Trace amplitude and spacing controls.
- 4 or 8 channel selector switch.
- 8 color coded input cable, 24" long with insulated alligator clips.
- External 9 VDC power supply included (Model MMAC-2).
- Size 6.25" x 3.75" x 2"
- BNC Output Cable Accessory (Model PSA-2 add $14.95).

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Connect this high quality low cost Capacitance Meter Module, DM-8 to your digital Volt Meter and turn it into a Digital Capacitance Meter — the Low Cost Way!

Completely assembled and tested! Ready to use!

- Push to read range (button) from 1pF to 20,000µF
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- In one easy to use, self-contained package.
- Battery powered, with "push to read" battery saver circuit (9V batteries not included.
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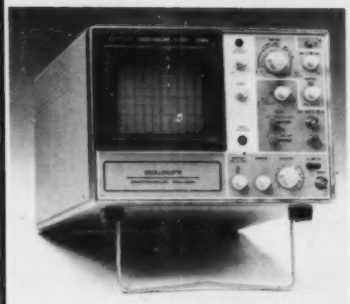

• CRT	130BUB31 (5-inch, round shape)
Display area	8x10div (1 div = 9.5mm)
Acceleration potential	Approx. 2kV
Intensity modulation	Over 5Vp-p
• Vertical deflection	
Sensitivity and bandwidth	5mV/div−5V/div ±5%, DC−15MHz, −3dB 1mV/div−1V/div ±6%, DC−5MHz Typ, −3dB (Using x5 amplifier)
Rise time	24ns
Dynamic range	More than 4div at 15MHz
Input R and C	Direct 1M Ohm, approx. 30pF
Maximum input voltage	600Vp-p or 300V (DC + AC peak)
Display mode	Single-trace
X-Y operation	DC−500 kHz, 200mV/div Phase difference DC−10kHz 3°
• Horizontal deflection	
Sweep mode	Auto, NORM, TV (+), TV (−)
TV synchronization	TV sync-separator circuit
Internal	Over 1 div (V sync-signal)
External	Over 1 Vp-p (V sync-signal)
Trigger sensitivity	

Frequency	Internal	External
20Hz−2MHz	0.5div	200mV
2−15MHz	1.5div	800mV

Trigger slope	±
Sweep time	0.2µs/div−0.2s/div ±5%, 19 calibrated steps
Sweep-time magnifier	10 times (±7%)
Max. sweep rate	150nS/div
• Amplitude calibrator	
Waveform	1kHz ±10% Typ, Square wave
Voltage	0.5V ±3%
• Power requirements	100V (120/220/240V) ±10% 50-60Hz, 40W
• Dimensions	Approx. 275(W) x 190(H) x 400(D)mm
• Weight	Approx. 8.5kg
• Ambient operation temperature	0− +40°C

MODEL V-151B WITH 2 YEAR MFG. WARRANTY

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LOW COST HIGH FREQUENCY COUNTER

MODEL NO. DM-7

The Albia Model DM-7, 8 Digit High Frequency Counter is easy to use, switch selectable time base input by a single BNC, nothing to build!

- 5 Hz to 550 MHz
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COMPLETELY ASSEMBLED PRE-CALIBRATED PRE-TESTED

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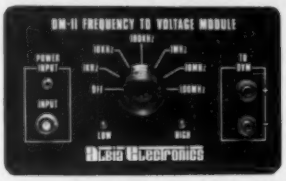
Measures resistance from 10 milliOhms to 20 Ohms. Now you can measure resistance down to 10 milliOhms with this low cost, easy to use DVM module. Check coil resistance, transformers, relays, chokes, printed circuit board copper paths and ground cables. Special zero balance control nulls out input cable resistance to insure accurate readings. Your DVM has to be set to 2V range during operation.

- Resistance range 10 milliOhms to 20 Ohms
- Zero Calibration control
- Battery powered (push to read battery saver circuit). Requires 1.9 Volt Battery (not included)
- Size 6.25" x 3.75" x 2" (Input cables not included or available)

$69.95

FREQUENCY METER MODULE "5Hz to 100MHz", DM-11



Measure frequencies from 5Hz to 100MHz on your digital voltmeter with a resolution of 3 1/2 digits — easy to use — perfect for field service — lab testing — home hobbyist! Connect the DM-11 to your DVM, set the DVM to the 2VDC range, connect a signal to the DM-11 via a BNC cable (not included) and measure the frequency of any source. Hi Lo Range LED's insure fast accurate readings.

- Frequency Range 5Hz to 100MHz
- Input Impedance 1 MegOhm
- Input Sensitivity: < 100Hz < 80MV
  100 Hz − 60MHz < 30MV
  > 60MHz < 70MV
- Size 6.25" x 3.75" x 2"
- External 9V DC power supply included. (Model MMAC-2)
- BNC Input Cable Accessory (Model PSA-2 add $14.95)

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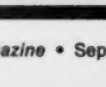

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PS-15 Power supply 149.00
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Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place. They should be sent directly to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458, Attn: Social Events.

GEORGETOWN IL
SEP 5-6

The Illiana Repeater System will hold the 12th annual Danville Area Hamfest on September 5-6, 1981, at the Georgetown Fairgrounds, Georgetown IL. The gates will open at 6:30 am. Tickets are $1.50 in advance and $2.00 at the gate. There will be a flea market, forums, family entertainment, many prizes (including a Santec synthesized hand-held), and free parking. Talk-in on 146.22/.82 and 146.52. For more information or advance tickets, contact Lowell Wells WD9AFG, Hamfest Chairman, RR 3, Box 215, Danville IL 61832, or phone (217)-759-7560.

BLOOMINGTON IN
SEP 6

The Bloomington Area amateur radio hams will hold their 4th annual Hoosier Backyard Hamfest on Sunday, September 6, 1981, rain or shine, from 7:00 am until 5:00 pm at 2335 Vernal Pike, Bloomington IN. Admission is $2.00. Features will include door prizes, a swap 'n shop, vendors, free setups, balloon rides, a 50/50 drawing, refreshments, ATV demonstrations, and an Aptron ATV converter as the grand prize. Talk-in on 147.78/.18, 146.04/.64, or 223.26/224.86. For further information, contact Bob Myers K9KTH at 2335 Vernal Pike, Bloomington IN, or call (812)-332-2433.

UNIONTOWN PA
SEP 12

The Uniontown Amateur Radio Club will hold its annual gabfest on September 12, 1981, starting at noon, on the club grounds located on the Old Pittsburgh Road, just off Route 51 and the 119 bypass, Uniontown PA (about 40 miles south of Pittsburgh). The pre-registration fee is $2.00 each or 3 for $5.00. There will be free parking, free coffee, and free swap and shop setups (bring your own table). Food will be available at our refreshment stand. Talk-in on 147.045/.645 and 146.52. For pre-registration and further information, contact UARC Gabfest Committee, c/o John T. Cermak WB3DOD, PO Box 433, Republic PA 15475.

AUGUSTA NJ
SEP 12

The Sussex County Amateur Radio Club will hold its third annual SCARC '81 hamfest on Saturday, September 12, 1981, from 8:00 am to 3:00 pm at the Sussex County Farm and Horse Show grounds, Plains Road off Rte. 206, Augusta NJ. Pre-registration for outdoor flea-market sellers is $4.00; at the gate, $5.00. Pre-registration for indoor flea-market sellers is $5.00; at the gate, $6.00. Other registration is $2.00. There will be door prizes and plenty of free parking. Talk-in on 147.90/.30 and 146.52. For additional information or pre-registration, write Sussex County Amateur Radio Club, PO Box 11, Newton NJ 07860, or Lloyd Buchholtz WA2LHX, 10 Black Oak Drive, Vernon NJ 07462.

MONTGOMERY AL
SEP 13

The Central Alabama Amateur Radio Association will hold its 4th annual hamfest on Sunday, September 13, 1981, at the Civic Center, downtown Montgomery AL. There will be free admission, free parking, and 22,000 square feet of air-conditioned activities, including a flea market. Setup will be at 0600, doors will be open from 0800 to 1500, and a prize drawing will be held at 1400 CDST. Restaurants and motel accommodations are located within a short walk of the Civic Center. Refreshments will be available in the Civic Center. Talk-in on 146.04/.64 or 146.52; rag-chew on 146.31/.91, 147.78/.18, or 147.045/.645. For further information or market reservations, write Hamfest Committee, PO Box 3141, Montgomery AL 36109.

PORT JEFFERSON LI NY
SEP 13

The Suffolk County Radio Club will hold its ARRL-supported 4th annual Electronic Flea Market on Sunday, September 13, 1981, with a rain date of September 20, 1981. The site is the Odd Fellows Hall, Jane Boulevard, Port Jefferson LI NY. Walk-ins will be $1.50 and sellers will be $3.00. There will not be any charge for XYLs and harmonics of attending hams. Gates will open at 7:00 am. Bargains, prizes, food, and hamship will be available. Talk-in on .52, .94, and 223.50. For more information, contact Floyd Davis at (516)-234-9376.

TIVERTON RI
SEP 13

The Bristol County Amateur Radio Association will hold its annual indoor/outdoor flea market on September 13, 1981, from 12:00 noon to 4:00 pm at the VFW hall in Tiverton RI. Admission is $1.00 and flea market spaces are $6.50. Door prizes will be drawn. Talk-in on 147.63/.03 and .52. For maps, send an SASE to Ann M. Carro KA1DNB, 652 Old Colony Terrace, Tiverton RI 02878.

FINDLAY OH
SEP 13

The Findlay Hamfest will be held on Sunday, September 13, 1981, at the Hancock Recreational Center, just east of I-75 exit 161, on the north edge of Findlay, 40 miles south of Toledo. Tickets are $2.00 in advance and $2.50 at the gate. Tables are $2.50 per half. Setups on Saturday are from 5:00 pm to 9:00 pm and on Sunday at 6:00 am. Major prizes include a deluxe low-band rig, two hand-helds, a memory keyer, and more. For tickets, information, or reservations, send an SASE to PO Box 587, Findlay OH 45840.

PENNSAUKEN NJ
SEP 13

The South Jersey Radio Association will hold its annual hamfest on Sunday, September 13, 1981, from 10:00 am to 4:00 pm, at the Pennsauken High School Grounds, Remington Avenue and US Route 73, Pennsauken NJ. Features will include a swap shop, tailgating, games, and door prizes. Food and refreshments will be available. Admission is $3.00; tailgate space is $5.00. Talk-in on 146.22/.82, 146.52, and 147.48. For information and reservations, contact Edwin T. Kephart W2SPV, 4309 Willis Ave., Pennsauken NJ 08109; (609)-663-6710.

GAITHERSBURG MD
SEP 13

The Foundation for Amateur Radio, with the support of more than 50 affiliated clubs in the greater Washington-Baltimore areas, will hold the Gaithersburg Hamfest on Sunday, September 13, at the Montgomery County Fairgrounds, Gaithersburg MD. Gates open at 8:00 am; setup and talk-in begin at 6:00 am. Events featured include commercial exhibits, indoor flea market, tailgating, and ladies' activities. Admission is $3.00 at the gate; children under 12 admitted free. For further information, write Foundation for Amateur Radio, PO Box 523, Bowie MD 20715, or contact Stuart Meyer W2GHK, hamfest chairman, 2417 Newton Street, Vienna VA 22180; (703)-525-6286 (office) or 281-3806 (home).

KEW GARDENS NY
SEP 13

The Hall of Science Amateur Radio Club will hold its annual electronic hamfest on Sunday, September 13, 1981, from 9:00 am to 4:00 pm, at the municipal parking lot, 80-25 126th street, Kew Gardens, Queens NY. Featured will be free parking, door prizes, refreshments, a raffle, and an auction. Sellers' spaces are $3.00; buyers' admission is $1.00. Talk-in on .52. For additional info, contact Tom Doyle KA2DTB at (212)-351-6354 (days).

HAMBURG NY
SEP 18

The 10th annual Ham-O-Rama '81 will be held on Friday and Saturday, September 18-19, 1981, from 7:00 am to 5:00 pm at the Erie County Fairgrounds near Buffalo NY. Advance tickets (deadline: September 4th) are $3.00 and tickets at the gate will be $4.00. Children under 12 will be admitted free. The outside flea market is $2.00 per space and the inside flea market

is $7.00 per space. Features will include new equipment displays, computers, technical programs, ladies' programs, and valuable awards. Talk-in on 146.31/.91. For advance tickets, send an SASE to David G. Baco WA2TVT, 130 Vegola Avenue, Cheektowaga NY 14225.

GRAND RAPIDS MI
SEP 19

The Grand Rapids Amateur Radio Association will hold its annual Swap and Shop on Saturday, September 19, at the fairgrounds in Hudsonville MI. There will be door prizes, dealers, an indoor swap area, and an outdoor trunk swap area. Gates will open at 8:00 am for both swappers and the public. Talk-in on 146.16/.76. For more information, write Grand Rapids Amateur Radio Association, Inc., PO Box 1248, Grand Rapids MI 49501.

GRAYSLAKE IL
SEP 19-20

The Chicago FM Club will hold Radio Expo '81 on September 19-20, 1981, at the Lake County Fairgrounds, Rtes. 45 and 120, Grayslake IL, about 30 minutes north of Chicago and 45 minutes south of Milwaukee. The flea market is open from 6:00 am to to 6:00 pm and the exhibits are open from 9:00 am to 9:00 pm on both days, rain or shine. Tickets, good for both days, are $3.00 in advance and $4.00 at the gate. Features include seminars, a ladies' program, prizes, free parking, a new camping site with hookups, commercial ham and computer displays, and full food services. Bring your own tables and chairs to the indoor and outdoor flea market (or even tailgate). Space is free with a gate ticket. Talk-in on 146.16/.76, 146.52, and 222.5/224.10. For more information, call (312)-BST-EXPO. For advance tickets, send a #10 SASE to Box 1532, Evanston IL 60204.

PEORIA IL
SEP 19-20

The Peoria Area Amateur Radio Club will hold the Peoria Superfest '81 on Saturday and Sunday, September 19-20, 1981, at the Exposition Gardens, W. Northmoor Road, Peoria IL. Gate opens at 6:00 am; commer-

Continued on page 102

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That They Might Communicate

—one group's efforts to get the vision- and hearing-impaired into hamming

Would you like to help another ham to break out of a silent, sightless world in which he or she perceives only through the senses of touch, taste, and smell? If you get the chance, you might have to slow down your code speed and sharpen your listening a bit, but when you are hit with the full impact of what you are helping another human to do, you just might shed a few tears of joy. Others have. You might even get hooked on the program to get the deaf and deaf-blind into ham radio, as members of the Scottsdale Radio Club have.

Unable to see well enough to read hand signs, J. C. Betner must receive Larry "Plato" Plate's (KA7JCJ) communications through "finger signing," wherein he "reads" the signs with his own sense of touch. Betner will soon be on the Novice bands, receiving code through one of Jack Lattin's (KA7BUT) vibrator boxes.

Led by Jack Lattin KA7BUT, Dottie Brown K7ESA, and Clyde Baker KB7BQ, a determined group of hams in the Valley of the Sun has constructed code "feeling" devices and purchased code viewers to instruct the deaf and the deaf-blind in learning Morse code. The hams have also set up a program for teaching radio theory and the practice of radio communications to the visually and hearing impaired.

You have only to visit the home of blind and deaf J.C. Betner and watch him receive coded messages through a fingertip to realize the value of this totally free program. Recently, in his silent, dark world, where he lives with three other vis-

ually and hearing-impaired people under the care of Irene and Louis Springgay, Betner was given the silent message that Jack Lattin and an article writer had arrived for his lesson in Morse code. Betner smiled, and in the measured, purposeful way of the blind, he walked from the living room to the kitchen and took a seat at the kitchen table, leaving the seat on his right for Jack Lattin.

A former accountant who was born deaf, Betner has long been locked in a narrow world where the feel of sunshine and the touch of a human hand were his greatest pleasures. He could talk with sign language, but he could "receive" nothing but finger spelling from another person grasping his hand and with various finger movements and pressures, communicating ideas. He wears glasses out of hope, but his eyesight is so poor that he recently spent all night in a bus after the driver had forgotten to let him out at his stop and had parked the bus, thinking it was empty. Also without the power of speech, Betner couldn't even call for help.

Jack Lattin came into Betner's life a year and a half ago. Jack had learned sign language and finger spelling from Gilbert Leon, a deaf coworker at Airesearch, twenty years earlier. Shortly before he met Betner, Jack had constructed a code buzzer for the deaf from plans he had seen in a magazine.

"But it didn't work," he said. "The cone was absorbing all the power the speaker had, and the deaf couldn't feel the buzzer well enough to distinguish between dots and dashes."

Jack boosted the speaker power to eight Watts and the relatively high wattage output overrode impedance-matching problems. Then Jack cut away most of the cone of the speaker and glued a 5/8" starter button to the center of the cone for the deaf to feel, and he had a vibrator strong enough of the deaf to sense dots and dashes easily. Glued to the inside bottom of a margarine tub or a wooden box, and with a finger hole cut in either, Jack's vibrator was ready to go to work teaching Morse code to the deaf and deaf-blind.

The blind quickly learn hamming through the Scottsdale Radio Club's program to help the handicapped. Here Cheryl Fitzwater KA7DWP enjoys operating her Heathkit rig built and provided free by SARC members. Cheryl's roommate, Cheryl Waters, who can see, tunes up the set and keeps the log.

It was one such vibrator box that he placed on the kitchen table in front of J.C. Betner when it was time for Betner's code practice session. Jack placed Betner's hand on the receiving box to get things rolling, and Betner stuck his forefinger through the vibrator hole and touched the button. Jack sent slowly-paced messages to Betner, telling about the good evening weather and important new events. After each letter, Betner gave the hand sign for the letter, and after each sentence, he signed the whole sentence.

Lattin kept on sending, and Betner's face broke into a grin like a kid's at a watermelon bust.

"The deaf like humor," Lattin said to the writer. "I just told him how fat you are."

Clyde Baker WB7BQ, a telephone company marketer, arrived to check out the TVI from Cheryl Fitzwater's (KA7DWP) Heathkit setup which had been provided to her by the Scottsdale Radio Club, members of which had built the set. Cheryl is blind but hears well, so she has no trouble communicating with standard equipment as long as her roommate, Cheryl Waters, who can see, tunes up the transmitter.

While Clyde worked on Cheryl Fitzwater's TVI problem, Jack Lattin continued sending to J.C. Betner, the whole lesson lasting about an hour.

"J.C. has really come on fast the last six months," Lattin said. "It was very slow the first year or so when he had to learn the code, but he'll be on the air soon now."

The full significance of going on the air to blind, deaf, and speechless J.C. Betner has gradually been communicated to Jack Lattin with signs and smiles.

"It will be like giving him the whole human race again," Lattin said. "It will give the world back to him."

Lattin's method of teaching the deaf looks simple. He has a deaf student touch one of his vibrator buttons, and then he sends code and has it appear on a Kantronics code-reader screen. For the deaf-blind, the method of instruction is obviously more complicated.

"First of all, you've got to be a good B-S'er," Lattin said. "I tell them with finger spelling that I'm going to teach them a whole new communications method. That really gets them interested because for them it *is* a whole new method."

Then Lattin introduces the deaf-blind to his code symbol board, where letters and

Not permitted to use bolts on club roof to attach antenna base built by Jack Lattin, the four original members of they Valley Center for the Deaf ham club demonstrate how they intend to weight the corners of the base frame. The four "bags of sand" are, l to r, Alan Wilson KA7JCR, Jim Goodson KA7JCS, Bruce Weir KA7JBA, and Larry "Plato" Plate KA7JCJ. Shack is located in Phoenix Lions' Club Building.

numbers are represented by dots made up of brads driven into the wood, and dashes are represented by flat-top metal staples driven into the wood. Lattin takes one hand of a deaf-blind student and places the fingers on the brads and staples representing a letter, and he takes the other hand and puts a finger on the same letter on a braille card.

"They get the idea pretty fast," Lattin said. "Then it's just a matter of a whole lot of practice."

Once the deaf-blind have mastered the code, Lattin moves them on to the vibrator. They learn the use of the vibrator by placing the fingers of one hand on the brad and staple code board and a finger of the other hand on the vibrator button. Then Jack slowly sends code to them and moves their fingers to the proper brad-staple letters and numbers that correspond to the letters and numbers they feel through the vibrator. Jack said the deaf and the deaf-blind are better motivated to learn than is a person with all senses intact.

"They try harder," he said. "The deaf get the receiving part of hamming down pretty fast," he said, "and the deaf-blind learn it quicker than you might think. But both groups have trouble with the difference in dots and dashes when they are sending."

Lattin solved the sending problem for the deaf very quickly when he bought his first Kantronics code reader and had them send into it.

"It won't show a letter or number on the screen unless it is sent practically perfectly," he said. "That frustrates them for a little while, but it motivates them to send clearly different dots and dashes."

For the deaf-blind, the problem can be solved only with many hours of patient instruction and many hours of private practice. Recently, Jack bought a Universal Data Transceiver 170 automatic keyer into which he can type practice messages and have them come out at a variety of speeds to be taped for both the deaf and the deaf-blind to practice with. Provided with a tape that can be run in a keyer that actuates either the Kantronics code reader or the vibrator, both groups can practice as many hours a day as they like.

"These tapes will make it possible to give practice to a lot more students than if somebody were to send code to them by hand," Jack said, "and it will be perfect code for all of them."

To date, four deaf hams have passed their Novice code and theory exams and have formed the first ham club for the deaf and deaf-blind in Arizona. Al Wilson KA7JCR and Bruce Weir KA7JBA have joined with Larry "Plato" Plate KA7JCJ, director for the Valley Center for the Deaf in Phoenix, and with Jim Goodson KA7JCS to establish the nucleus of a communications group that will put the deaf and deaf-blind in daily contact with each other. With help from their friends in the Scottsdale Radio Club, they have set up the Dottie Brown radio room in the Valley Center for the Deaf.

"It's the first ham shack in the world for the deaf and deaf-blind," said Dottie K7ESA, after whom the shack is named.

Once skeptical of the aid offered by the Scottsdale Amateur Radio Club, the four deaf club members had a flyer printed up which they passed out at a recent carnival for the deaf, in which they said, "SARC (Scottsdale Amateur Radio Club) has been totally devoted in volunteering hours and in being patient in working with us."

"We can see," the report went on, "that in the future the deaf and presumably the deaf-blind will be able to use ham radio with Morse code or teletypewriter in substitution for audio conversation to people in all parts of the world."

The group had special thanks for Jack Lattin and Clyde Baker, giving Jack credit for using his ability to communicate with the deaf "to stimulate us to want to study," and thanking Clyde for teaching them electronics theory.

Behind every good man there is a woman, the saying goes, and according to Jack Lattin there is a great woman behind the radio program for the deaf and deaf-blind. That woman is Dottie Brown K7ESA, mentioned earlier.

"Without Dottie, there would be no program," Lattin said. "She raises all of the money and scrounges the parts to build the vibrator units and to buy transmitters, receivers, and viewers for the handicapped."

A former writer-photogra-

pher for a Bangor, Maine, newpaper, Dottie has transferred her drive from news gathering to fundraising, and with considerable success. By raffling off a pair of handheld transceivers, she netted $1200 which was used to help buy a Century 21 transceiver, a Kantronics Mini-reader, and a TRAC Message Memory Keyer. She picked up an additional $435 raffling off a frequency counter at a hamfest. When the $1635 didn't stretch far enough, Dottie noticed a refuse container full of aluminum cans in a friend's title guarantee office, and she got permission to collect and sell the cans. A young janitor in the title guarantee building increased the number of cans for Dottie by charging non-employees two empty cans for each full one taken, and a nurse in a hospital scrounged up hundreds more. The ever-loyal Scottsdale Radio Club members brought bags of cans to club meetings for Dottie, and eventually the equipment was bought and given to the Deaf Center radio shack.

"I found out that can collectors for charity get ten percent more from the reclaimers, too," Dottie said. "That will help us to buy more equipment."

Assisting Dottie in procuring equipment is the membership of the Thunderbird Council of Telephone Pioneers, whose retired and longtime members of the Telephone Company collect old radio and television parts. Chet McClellan K7HNM, Jack Fuller W7AVX, and Carl Wolford N7AJK handle most of the salvaging of parts and the building of vibrator boxes.

Special help, according to Jack Lattin, came from Field Engineer Earl Carpenter and his Long Beach, California, Federal Communications Commission staff in the area of instructing and licensing the deaf and deaf-blind.

At this point, the ham radio program for the deaf and deaf-blind is a winner. Jack and Clyde have completed the training of four deaf and deaf-blind instructors who are beginning the instruction of other hams-to-be. Two classes of deaf, ten to a class, are beginning their training, and four deaf-blind are being prepared for instruction.

It hasn't all been easy. There have been disappointments, such as Jack's spending six months trying to teach Morse code to a deaf-blind girl before he learned that she had learned only about six words in braille. It was impossible to teach her to use code until she was sent to a deaf-blind school where she will be taught a functional vocabulary by specially-trained instructors. She had apparently been one of the forgotten ones that nobody pays much attention to.

"She'll be ready for radio instruction after a while," Jack said optimistically. "Then we'll be able to teach her Morse code and ham radio."

There are encouraging signs that the program to teach ham radio to the deaf and deaf-blind could spread out from Arizona to the rest of the country and to other parts of the world. Jack has gotten calls and letters from people as far away as France who are thinking about setting up code and theory classes for their deaf and deaf-blind.

One day, Dick Wharton W4LWI dropped in to the Valley Center for the Deaf and told Dottie Brown that he had made a vibrator after the pattern conceived by Jack Lattin and was teaching a deaf person in his home town of Norfolk, Virginia.

For Jack Lattin, the deep meaning of what he is doing comes through the signing fingers of his promising deaf-blind student who tells him simply and with a smile, "Jack Lattin and J.D. Betner." Jack knows exactly what he means.

Hams on CW are sure to hear the enthusiastic deaf radio operators operating from the Dottie Brown radio shack in the Valley of the Sun. They are working in the Novice frequencies now, and soon they will be working the General and Advanced frequencies. If you are especially lucky, you may soon hear J.C. Betner or one of the other deaf-blind hams calling CQ from his dark and silent world. He'll be sending slowly, and he won't say he's deaf and blind until after you've hooked up with him. But when he does, and you think of how you are communicating with another human mind in a way that recently seemed impossible, you will get a thrill you will never forget.

And if you come to the Valley of the Sun, drop in and visit with the deaf hams in the Dottie Brown radio room of the Valley Center for the Deaf in the Lions' Club Building in Phoenix. They will catch on fast if you can't talk sign language. They will read your lips and write messages to you, and you will have a satisfying eyeball QSO. You might even get to see J.C. Betner or one of the other deaf-blind operators running the rig.

Should chance or intent bring you to Scottsdale from October 9 to 11, catch the Southwest District Convention of the ARRL in the Safari Hotel. The Scottsdale Radio Club will have a booth manned by deaf members demonstrating handicapped ham radio, and they hope to have deaf-blind members there who will communicate briefly with visitors by code. Getting in on that would give you free an experience that would top having any of the souvenirs you could buy on Scottsdale's famous Fifth Avenue.■

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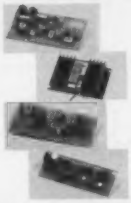

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A Cost-Effective Approach to OSCAR

—sources and suggestions for getting started

Editor's Note: At press time, the latest word on OSCAR 7 was that it was barely alive! What is apparently a battery short has put this bird on the endangered list. So, don't try to access the satellite—just listen for it and pass your findings on to AMSAT. For the full story, see "Death of a Satellite" on page 97.

Taylor Klett KA5EIM
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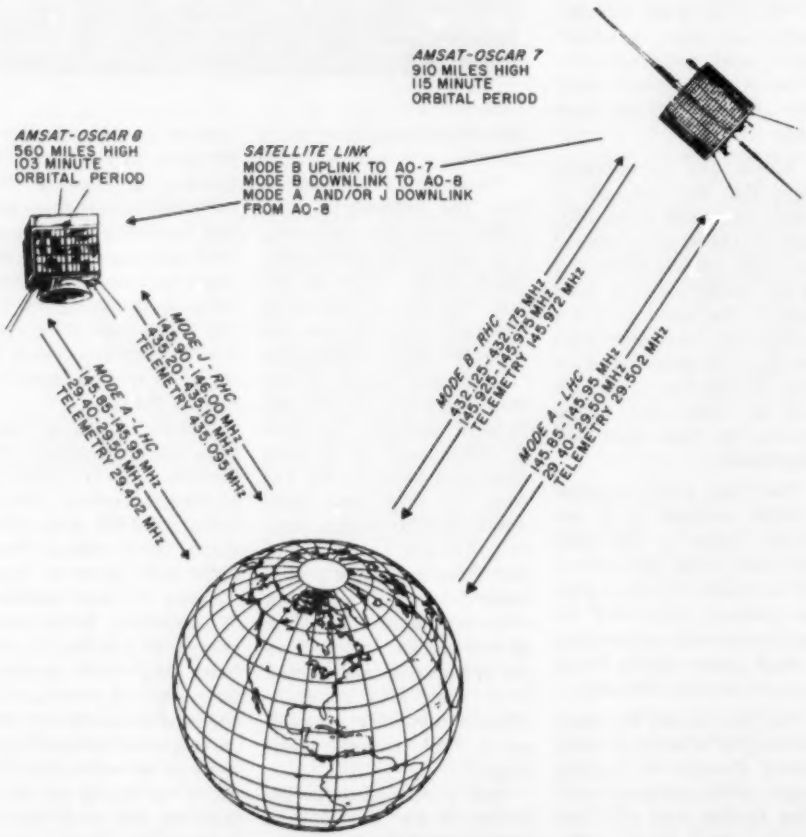

Fig. 1. Frequency and orbital relationships.

Every time I look at the advertisements in my favorite ham magazines, I envision the ultimate "superstation" ready to zap any unwitting amateur satellite that dares to get within range of my home. But then reality steps into the picture. How dare everyday living expenses take precedence over such a glorious dream?

I feel that many a potential OSCAR enthusiast or old pro has had his enthusiasm dampened when the prices of the various components seemingly needed to accomplish satellite communications came head to head with the family budget. Others read about exotic equipment used by some operators and don't realize that much simpler rigs are all that are really needed to operate effectively.

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just slightly ahead of our time.

What I hope to do in this article is to give you some practical and cost-effective ideas and alternatives with the goal of no lost operating efficiency. I do not intend to provide an introduction to OSCAR communications, its history, or its operating procedures. These topics have been covered many times in various articles in the ham magazines. A very good source of this type of information is the "Satellite Communications" package available from the ARRL and at most ham shops. This includes reprints of previously published articles in *QST* and also includes three OSCAR-locators™—a device used to locate the satellites.

I have included a few operating aids that could save you some time and frustration in attempting your first satellite contact. Also included in the article is a list of equipment suppliers that can save you some time-consuming research.

The Bare Requirements for Those Who Have Nothing

Any amateur who has a rig capable of operating in the ten-meter band or has a multi-mode two-meter radio has a tremendous head start. The lucky ham who already has some equipment merely needs to read on, substituting his equipment in the obvious spots.

Let's briefly review just what frequencies we need to operate on both the existing birds and the planned AMSAT-OSCAR Phase IIIB. Mode A's uplink is 145.85-145.95 MHz, with the downlink at 29.4-29.5 MHz; Mode B's uplink is 432.125-432.175 MHz, with the downlink at 145.975-145.925 MHz (inverted); Mode J's uplink is 145.9-146.0 MHz, with the downlink at 435.2-435.1 MHz (inverted); and Phase IIIB's planned Mode B transponder's uplink is 435.3-435.15 MHz, with the downlink at 145.97-145.82 MHz (inverted). The common denominator of all these combinations is the capability to transmit and/or receive on two meters.

The station requirements aren't like those for regular terrestrial transceive operations, due to the very nature of the satellite transponders. As Fig. 1 shows, the satellite accepts one transmitted frequency, amplifies it, and linearly translates the signal into the transmitted downlink frequency. Two rigs (or a separate transmitter and receiver) are required for this duplex operation.

It's not impossible to operate with a single transceiver (with the proper converter) into the spacecraft; several hams have done it. However, the Doppler shifts (frequency changes in received signal due to satellite motion in relation to the ground station) and the inability to hear the strength or quality of one's downlink while transmitting usually cause hopping back and forth in the passband and cause unnecessary QRM. It really is preferable to operate with two independent units, be they two separate transceivers or a separate transmitter and receiver combination.

Let's begin with equipment commercially available and develop alternatives for all three operational modes. Almost any multi-mode two-meter radio on the market today will serve you well and also give you a nice, solid ten-Watt output. Another nice benefit is FM, if you're into that. But those multi-mode units are expensive.

A cheaper alternative is the Icom 202S or 202, which allows SSB and CW two-meter operation within the 200-kHz range of OSCAR operations. It gives you, after the installation of the readily-available crystal, three primary mode capabilities: uplink with a linear amplifier on Mode A and Mode J or barefoot on QRP days (UTC Mondays) and downlink on Mode B. The radio has a very hot receiver—in fact, downlink on Mode B easily can be copied from horizon to horizon with the collapsible antenna provided. (Of course, much better reception results with the use of an external antenna.)

The radio has an output of three Watts PEP and can operate independently with its self-contained battery pack. The Icom 202 can be modified to receive lower sideband (it only transmits and receives upper sideband) and is available used at very reasonable prices. The Icom 202S already has the lower sideband capability. Articles in the September, 1978, and December, 1979, *AMSAT Newsletter* illustrate the conversion, or you can contact Icom directly for conversion information.

The twin to the 202S is the 402, Icom's 432-435-MHz SSB/CW transceiver. This radio also has a hot receiver section, while the transmit section also has an output of three Watts PEP. The 402 retails for approximately $100 more than the 202S. With the appropriate crystals, this radio covers the OSCAR 7 and Phase IIIB Mode B uplink frequencies and the OSCAR 8 Mode J downlink frequency. Icom recently introduced the new IC-451A, a 432-MHz multi-mode radio capable of ten-Watt output, similar to their two-meter multi-mode series. KLM also has available a 432-435-MHz SSB/CW transceiver with a ten-Watt output.

Other commercial radios are available, and while these radios could prove to be the cornerstones of your operations, there are cheaper alternatives. If straight CW is your bag, the Ameco 62 (AM/CW only) provides an excellent two-meter uplink at a good workable power level. The radio can be operated VXO (variable crystal oscillator) with the modifications as described by Raphael Soifer in the March, 1976, *AMSAT Newsletter*. The radio easily can drive a varactor tripler to 432 MHz for a CW signal that won't need an amplifier for OSCAR 7. This is a very popular radio with the CW crowd. The Ameco often can be had for less than $100 through ads, at hamfests, and as used equipment at ham shops.

The local pawn shop, want ads, or flea market may provide one of the cheapest and best additions you can ask for: an SSB/AM CB radio. Most of the phase-locked loop radios are capable of extended-frequency operation and expanded-clarifier (VXO) operation. This inexpensive radio (after conversion) could truly turn out to be the workhorse you have been needing: downlink for Mode A and, with separate downconverters, for Mode B and/or J, and, finally, rf drive for your 145-MHz and/or 432-435-MHz uplink converter.

It should be noted that the new CBs have a much sharper and more sensitive receiver than almost any ham rig capable of operating in the ten-meter range. Obviously, this is a tremendous asset for operating; as we all know, you have to hear 'em before you can work 'em. The cost is nice, too. Two new or recycled CBs, after commercial conversion (if desired), plus the purchase of the required

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74LS33	.55	74LS241	1.85
74LS37	.55	74LS242	1.85
74LS38	.35	74LS243	1.85
74LS40	.25	74LS244	1.75
74LS42	.55	74LS245	2.85
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7445	.69	74178	1.15
7446	.59	74179	1.75
7447	.69	74180	.75
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7450	.19	74182	.75
7451	.23	74184	2.00
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7454	.23	74186	18.50
7460	.23	74190	1.15
7464	.39	74191	1.15
7465	.39	74192	.79
7470	.35	74193	.79
7472	.29	74194	.85
7473	.34	74195	.85
7474	.35	74196	.79
7475	.49	74197	.75
7476	.35	74198	1.35
7480	.59	74199	1.35
7481	1.10	74221	1.35
7482	.95	74246	1.35
7483	.50	74247	1.25
7484	.50	74248	1.85
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74S37	1.87	74S151	1.19	74S225	8.95	74S471	9.95
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74S51	.78	74S158	1.45	74S251	1.90	74S482	15.60
74S64	.79	74S161	2.85	74S253	7.45	74S570	7.80
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145.851	29.401	-	-
145.852	29.402	-	-
145.853	29.403	-	-
145.854	29.404	-	-
145.855	29.405	-	-
145.856	29.406	-	-
145.857	29.407	-	-
145.858	29.408	29.400 MHz	-
145.859	29.409	29.401	-
145.860	29.410	29.402	-
145.861	29.411	29.403	-
145.862	29.412	29.404	-
145.863	29.413	29.405	-
145.864	29.414	29.406	-
145.865	29.415	29.407	-
145.866	29.416	29.408	-
145.867	29.417	29.409	-
145.868	29.418	29.410	-
145.869	29.419	29.411	-
145.870	29.420	29.412	-
145.871	29.421	29.413	-
145.872	29.422	29.414	-
145.873	29.423	29.415	-
145.874	29.424	29.416	-
145.875	29.425	29.417	-
145.876	29.426	29.418	-
145.877	29.427	29.419	-
145.878	29.428	29.420	-
145.879	29.429	29.421	-
145.880	29.430	29.422	-
145.881	29.431	29.423	-
145.882	29.432	29.424	-
145.883	29.433	29.425	-
145.884	29.434	29.426	-
145.885	29.435	29.427	-
145.886	29.436	29.428	-
145.887	29.437	29.429	-
145.888	29.438	29.430	-
145.889	29.439	29.431	-
145.890	29.440	29.432	-
145.891	29.441	29.433	-
145.892	29.442	29.434	-
145.893	29.443	29.435	-
145.894	29.444	29.436	-
145.895	29.445	29.437	-
145.896	29.446	29.438	-
145.897	29.447	29.439	-
145.898	29.448	29.440	-
145.899	29.449	29.441	-
145.900	29.450	29.442	-
145.901	29.451	29.443	-
145.902	29.452	29.444	-
145.903	29.453	29.445	-
145.904	29.454	29.446	-
145.905	29.455	29.447	-
145.906	29.456	29.448	435.200 MHz
145.907	29.457	29.449	435.199
145.908	29.458	29.450	435.198
145.909	29.459	29.451	435.197
145.910	29.460	29.452	435.196
145.911	29.461	29.453	435.195
145.912	29.462	29.454	435.194
145.913	29.463	29.455	435.193
145.914	29.464	29.456	435.192
145.915	29.465	29.457	435.191
145.916	29.466	29.458	435.190
145.917	29.467	29.459	435.189
145.918	29.468	29.460	435.188
145.919	29.469	29.461	435.187
145.920	29.470	29.462	435.186
145.921	29.471	29.463	435.185
145.922	29.472	29.464	435.184
145.923	29.473	29.465	435.183
145.924	29.474	29.466	435.182
145.925	29.475	29.467	435.181
145.926	29.476	29.468	435.180
145.927	29.477	29.469	435.179
145.928	29.478	29.470	435.178
145.929	29.479	29.471	435.177
145.930	29.480	29.472	435.176
145.931	29.481	29.473	435.175
145.932	29.482	29.474	435.174
145.933	29.483	29.475	435.173
145.934	29.484	29.476	435.172
145.935	29.485	29.477	435.171
145.936	29.486	29.478	435.170
145.937	29.487	29.479	435.169
145.938	29.488	29.480	435.168
145.939	29.489	29.481	435.167
145.940	29.490	29.482	435.166
145.941	29.491	29.483	435.165
145.942	29.492	29.484	435.164
145.943	29.493	29.485	435.163
145.944	29.494	29.486	435.162
145.945	29.495	29.487	435.161
145.946	29.496	29.488	435.160
145.947	29.497	29.489	435.159
145.948	29.498	29.490	435.158
145.949	29.499	29.491	435.157
145.950	29.500	29.492	435.156
145.951	-	29.493	435.155
145.952	-	29.494	435.154
145.953	-	29.495	435.153
145.954	-	29.496	435.152
145.955	-	29.497	435.151
145.956	-	29.498	435.150
145.957	-	29.499	435.149
145.958	-	29.500	435.148
145.959	-	-	435.147
145.960	-	-	435.146
145.961	-	-	435.145
145.962	-	-	435.144
145.963	-	-	435.143
145.964	-	-	435.142
145.965	-	-	435.141
145.966	-	-	435.140
145.967	-	-	435.139
145.968	-	-	435.138
145.969	-	-	435.137
145.970	-	-	435.136
145.971	-	-	435.135
145.972	-	-	435.134
145.973	-	-	435.133
145.974	-	-	435.132
145.975	-	-	435.131
145.976	-	-	435.130
145.977	-	-	435.129
145.978	-	-	435.128
145.979	-	-	435.127
145.980	-	-	435.126
145.981	-	-	435.125
145.982	-	-	435.124
145.983	-	-	435.123
145.984	-	-	435.122
145.985	-	-	435.121
145.986	-	-	435.120
145.987	-	-	435.119
145.988	-	-	435.118
145.989	-	-	435.117
145.990	-	-	435.116
145.991	-	-	435.115
145.992	-	-	435.114
145.993	-	-	435.113
145.994	-	-	435.112
145.995	-	-	435.111
145.996	-	-	435.110
145.997	-	-	435.109
145.998	-	-	435.108
145.999	-	-	435.107
146.600	-	-	435.106
146.601	-	-	435.105
146.602	-	-	435.104
146.603	-	-	435.103
146.604	-	-	435.102
146.605	-	-	435.101
146.606	-	-	435.100
Telemetry	29.502	29.402	435.095

Table 1. Mode A and Mode J frequency relationships (± Doppler).

converters will be cheaper than the purchase of a single new or used multimode rig. With luck, recycled rigs could be cheaper than the cost of the new Icom 202S described earlier. Thus, the recycled CB could prove to be both highly useful and cost effective.

Even cheaper are the CB boards available from various sources. These boards can be modified to receive SSB/CW signals and can be used to provide rf drive for CW into converters or varactors (as could an AM CB radio). The board(s) also could be dedicated to receive the telemetry channel(s) of both the existing satellites and the upcoming birds. A recent ad offered two of these boards for $25. A note to the wise, though: Be sure to specify the sixteen-pin PLL 02A boards, as the eighteen-pin boards may be next to impossible to convert. Two of the best conversion articles are in the June and September, 1980, issues of *73 Magazine*.

Kits can save many dollars if you have the time and necessary equipment available. Something to remember is that unassembled kits gathering dust do not pay off as do already-assembled operating units. You have to decide how much time you have and just how valuable it is to you, weighing also the educational aspect of the construction project.

For CW-only operation, for both 145 MHz and 432-435 MHz, new FM transmit board kits can be purchased for under $50 to provide drive for a suitable amplifier. The boards usually provide one to two Watts output barefoot. These boards are for crystal-controlled operation, but many on-the-air operators are using them with great success. Someone must have come up with a VXO scheme by now.

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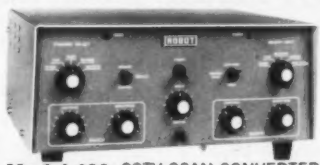

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25 watts	—	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
2500 watts	2500H					
5000 watts	5000H					

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UHF is a varactor tripler which can cheaply convert 144-MHz signals into 432-MHz CW output. Varactor designs can be found in the ARRL *Handbook* and in the September, 1976, *AMSAT Newsletter*. This device can triple your 144-MHz drive to 432 MHz (or 145 MHz to 435 MHz for Phase IIIB). Depending upon signal input into the device, there may be no need for an amplifier. The typical efficiency is around 60%. Remember that the device is useful only for CW operation. It will not linearly translate SSB.

Kits and assembled units are available for linear transverters and converters capable of operation in almost any desired band or frequency. For example, kits or completed units are available for converting received ten-meter signals into two-meter signals for those persons possessing a two-meter radio. Usually these transverters take ten-meter (or two-meter, depending on the unit) rf drive and linearly convert that signal into the desired output frequency. The resulting output varies from a few milliwatts up to two Watts (again depending on the unit), usually just the right amount to drive an amplifier.

The receiving converters operate on the same principle. Naturally, the higher the frequency the higher the cost, and also the more critical the construction techniques required. The beauty of these transverters and converters lies in their ability to be adjusted to various frequency requirements merely by crystal changes. For example, you can permanently convert your SSB CB radio to the 29.4-29.5-MHz Mode A downlink frequency and still use this radio to provide your intermediate frequency (i-f). I-f is the frequency that is mixed with the transverter's or converter's crystal-generated harmonics and results in the final product, either transmitted or received. The "normal" comparison is 28.0 MHz, equaling 432 or 435 MHz (crystal frequencies of 44.888 MHz or 45.222 MHz multiplied by nine and added to 28.0 MHz).

As is obvious, all that really needs conversion—if the 28.0-MHz or 144.0-MHz i-f is not precisely available (but is reasonably nearby)—is the rather cheap converter crystal. In other words, you could use the orginal frequencies the CB radio generated, if you so desired. You probably would want to expand the clarifier adjustment to allow the radio to expand both its transmit and receive variable capability to 10 kHz (the difference between channels). Another advantage is that the converter can be remotely mounted at the antenna or in the attic closer to the antenna, both of which placements reduce line loss.

Antennas: Large Signal from Small Size

Antennas have been and will be exhaustively discussed everywhere. As hams know, there never has been a perfect design for all applications. While many antennas give the overall desired results, the inborn tinkering instincts of most hams dictate modifications and/or designs of their own. Satellite antennas are no exception, especially since signals to and from the satellite experience Faraday rotation. This effect causes fading and loss of signal if the antenna is not circularly polarized. (See the ARRL's *Satellite Communications* for a more technical explanation.) Obviously this effect opens up a fertile area for antenna design and experimentation.

The nice things about VHF/UHF antennas are their relatively low cost and small size. These antennas can fit easily into most zoning laws and regulations of local neighborhoods, especially since the antennas are not 50-150 feet in the air. These antennas can be mounted easily low on the roof, or even at ground level. You can experiment cheaply with various designs and approaches as you dream them up. The connectors may cost as much or more than the other materials in the antenna! Home-built antennas do require accuracy in measurements, especially at UHF, but there is no real problem if you're careful.

For Mode A downlink, an inverted single-loop quad with a preamplifier is a very cheap but effective antenna and is easily placed out of sight in your attic or attached to your ceiling. This antenna is essentially a full-wave loop pointing straight up. Bernie Glassmeyer of ARRL headquarters is the designer of this antenna and will supply you with the design for an SASE. Briefly described, the loop is 34' 1" of regular antenna wire, with a 5.5', 72-Ohm coax cable matching stub into a 52-Ohm coax mate.

Of course, other antennas are useful, such as converted CB antennas, dipoles, and existing ten-meter beams. However, the ten-meter directional antennas are really effective up to 30° above the horizon. Unless you can control or modify your elevation, you really need the inverted-loop quad above this elevation. Some possibilities include permanently tilting your directional antenna 30°+ above the horizon, but you may still get overhead fading and/or nulls. This is due to the beamwidth and orientation of your antenna—the higher the gain, the more compressed is your beamwidth. Your antenna is not circularly polarized, either, which contributes to the fades. These considerations normally are not a concern for non-OSCAR operations, but our little birds up there are consistently changing their positions relative to ourselves at 15,000 mph!

Uplink Frequency	Mode B Downlink
432.125 MHz	145.975 MHz
432.126	145.974
432.127	145.973
432.128	145.972
432.129	145.971
432.130	145.970
432.131	145.969
432.132	145.968
432.133	145.967
432.134	145.966
432.135	145.965
432.136	145.964
432.137	145.963
432.138	145.962
432.139	145.961
432.140	145.960
432.141	145.959
432.142	145.958
432.143	145.957
432.144	145.956
432.145	145.955
432.146	145.954
432.147	145.953
432.148	145.952
432.149	145.951
432.150	145.950
432.151	145.949
432.152	145.948
432.153	145.947
432.154	145.946
432.155	145.945
432.156	145.944
432.157	145.943
432.158	145.942
432.159	145.941
432.160	145.940
432.161	145.939
432.162	145.938
432.163	145.937
432.164	145.936
432.165	145.935
432.166	145.934
432.167	145.933
432.168	145.932
432.169	145.931
432.170	145.930
432.171	145.929
432.172	145.928
432.173	145.927
432.174	145.926
432.175	145.925

Telemetry: 145.972 MHz

Table 2. Mode B frequency relationships (± Doppler).

The turnstile antenna also is a cheap and effective antenna that can be built easily for 145-MHz and 432-MHz transmitting without worrying about tracking the satellite. This antenna is especially recommended for the novice at satellite operation. The prime advantage is the reasonable gain achieved without the need to track the satellite's motion. Of course, signal levels may not be the highest S-9s, but the idea is to gain the needed experience with the

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TERMINALL was designed from the outset to be easy to connect to your radio and easy to use. Plug into your receiver headphone jack and copy Morse code or radioteletype (RTTY). Plug into your CW key jack and send Morse code. Attach a microphone connector and send Baudot or ASCII RTTY using audio tones (AFSK). That's all there is to hooking it up.

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■ **Outstanding documentation.** Professionally written, 90 page user manual - contains: step-by-step instructions - explicit examples - numerous photographs and illustrations - theory of operation -parts layouts - schematic diagrams - trouble shooting guide.

■ **Built in software backup** - set up the program parameters and messages the way you like to operate - then have the program save a new copy of itself -on either cassette or disk!

■ **Software** supplied on both cassette and auto-run diskette at no additional cost.

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least possible amount of frustration. You will have plenty of time to get into more directive antennas and az-el (azimuth/elevation) later. This antenna can be built cheaply from almost any material available. A good article on this antenna's construction is in *Satellite Communications*.

Various VHF/UHF antenna designs have been offered by various authors, including quads, quagis, helicals, and crossed yagis. Excellent construction articles are referenced at the end of this article.

Quality commercial antennas are available from several reputable manufacturers (see Table 3). Cushcraft also offers an az-el mounting boom perfect for use with the Alliance U-100 rotor I will mention later. These antennas commercially available are crossed yagis with matching harnesses to provide an adjustable (i.e., left- or right-hand) circular polarization. These antennas usually have ten elements plus and provide 13 dB gain or more.

Something to remember, with whatever type of UHF antenna you do use, is that you should try to keep the line of sight clear to the satellite if at all possible. Unlike HF, signals on these frequencies are absorbed by trees and the like.

Preamplifiers, or How to Copy the Weak Ones

It is remarkable that we amateurs can hear and communicate through our OSCAR satellites when you consider the many factors against it, such as: the up-/downlink attenuations of the atmosphere, the relatively low power output from the satellite (100-milliwatt output on telemetry to a peak of two to ten PEP on the transponders), and so on.

But we can. And most of us are not merely satisfied to hear a weak signal when, with a little extra effort and expense, we can copy strong signals without an increase in transmitted power. The best selling point about preamplifiers is the increase in sensitivity and selectivity to the receiving system for a relatively low cost. Preamps are commercially available for all the downlink frequencies (see Table 3).

Preamps normally are located at the antenna or in the attic as close to the antenna as possible, to allow peak efficiency. If the downconverter (especially for Mode J) is located at the antenna just following the preamp, maximum signal strength is achieved due to the UHF signal not being absorbed by the coax. Ten-meter signals are not attenuated nearly as much as those higher VHF/UHF frequencies. Power to the preamp located at the antenna can be duplexed up the coax to the antenna mounting to reduce additional wiring, if desired. The power requirement for these devices is quite low, and, in a pinch, a nine-volt transistor battery will suffice nicely.

Most enthusiasts use the preamps on Modes A and J. Mode B users, with adequate gain on their two-meter antennas, usually do not need a preamp. Signal levels for OSCAR 7 usually are more than sufficient for adequate reception, but it all depends on the station's receiver sensitivity, antenna, and length and type of coax used. It should be noted that most authorities are recommending the use of a preamp for the downlink from the Phase III satellites. One thing not usually mentioned is the possibility of achieving too *much* gain, thereby overloading the receiver and effectively reducing the quality of the signal. If overloading does occur, it usually occurs on direct overhead passes.

The purist on Mode J may want to resort to a more expensive low-noise preamp, but to get started, good results are achieved daily with the less-expensive but higher noise figure preamps. Another benefit of the less-expensive preamp for Mode J is its resistance to overloading and the resulting need for cavity filters (such as the 4×3×5 filter in *Satellite Communications*). The overloading, if it occurs, is a direct result of the 435 downlink being the third harmonic of the 145-MHz uplink. Usually the overload/crosstalk desense occurs in the more sensitive UHF preamplifiers.

These preamplifiers are readily available from commercial sources. They may be purchased anywhere for $12.00 for a kit on up to an average ready-built price of $25.00.

Another nice thing about preamps is the many good home-brew designs that are available using inexpensive parts. The *AMSAT Newsletter, 73,* and the ARRL *Handbook* all have carried several designs for the various frequencies and additional references are at the end of this article.

All in all, you can expect 12-20 dB of amplification of the received signals by use of the preamplifiers. If the noise figure of the preamplifier is below 2 or 3 dB, this amplification is generally enough to ensure that no deep fades are constantly encountered, assuming the use of a circularly-polarized antenna.

Az-El, or To Point or Not To Point?

Many methods are employed by OSCAR users to point antennas at orbiting birds. As with most things, results depend on what the individual wants to spend.

One of the easiest methods is to use simple omni-directional antennas, preferably with preamps for receiving and a slightly higher output power into an omni-directional antenna for transmitting. Unfortunately, omni antennas do not furnish an abundance of gain; thus the need for higher power. This is not always needed, however, during periods of low load such as on weekday mornings and on QRP days.

Another easy method is the tilting of the directional antennas at the mast 30° + above the horizon and using a regular rotor (if you have one) as the azimuth movement. The primary problem with this approach is on overhead passes, where the station could then experience a null. The null lasts only two minutes or so, however, and the vast majority of the time the satellite doesn't pass directly overhead. This is probably the cheapest of all the alternatives involving a directional antenna, other than pointing antennas by handpower.

The drawback with using higher power into omni-directional antennas for constant use after you've gained your initial experience on the satellite is that the cost of the amplifier usually required to get the signal *consistently* into the bird exceeds the cost of two Alliance U-100 rotors and two directional VHF/UHF antennas. Two U-100 rotors and the commercially available mounting boom mentioned above (or a homemade mount) can easily furnish you both azimuth and elevation control.

Many hams use a heavier rotor for the azimuth rotor, but the U-100 is capable of handling the small antennas *and* a sister U-100 for this function. It does have the tendency to lose orientation in high winds, but several articles by Jim Bartlett in June and Sep-

tember, 1979, *QST* give some excellent methods of superior az-el control at a very reasonable cost. Nonconversion is quite acceptable, as well, however, as the rotors track in 10° progressions. The advantage of the Bartlett system is its precise tracking (within two or three degrees) of the birds. This is exceedingly useful for high-gain, narrow-beamwidth antennas such as those for use with Phase IIIB, and another benefit is that no recalibration is necessary after windstorms.

More expensive elevation and azimuth rotors are available but really aren't needed unless you want to get into EME or computer control. An excellent article on computer control was in the November/December, 1980, issue of *Orbit*, the AMSAT magazine. In that article, the author describes the computer program, the interface needed, and conversion mechanical aspects.

Essentially, az-el takes the place of more expensive linear amplifiers at a less expensive price, but it also takes its toll in necessary attention during flyby operation. You have to orient two rotors, adjust for Doppler, etc., and operate. (But that's part of the fun! If nothing else, imagine your neighbor catching glimpses of your antenna moving in some rather peculiar fashions, wondering if he is going crazy.) You also need to know where the satellite will be at three-minute intervals. Many calculator programs and computer programs have been written to solve this problem for you or you can "eyeball" it by using your OSCAR-locator™ or Satellabe™. If your antenna does not have too narrow a beamwidth, this method, in conjunction with listening to your downlink, can usually suffice.

Source	Amplifier (Linear)	Antennas	CB Board	CB Conversions	435 Cavity Filter	Crystals	Converters or Transverters Rcvr	Converters or Transverters Xmit	Coax Phasing Harness	Exciter Boards	Mounting Boom	Parts	Preamp	Rotor	Transceiver
Alliance Manufacturing Co. Alliance OH 44601														M	
American Crystal Supply Co. PO Box 638 W. Yarmouth MA 02673				KC		Yes									
ARCOS PO Box 546 East Greenbush NY 12061	KC	M					KC	KC	M			Yes			
Advanced Receiver Research PO Box 1242 Burlington CT 06013					M		M						M		
Certified Communications 4138 S. Ferris Fremont MI 49412		M		M		Yes						Yes			
Cushcraft Corporation PO Box 4680 Manchester NH 03108		M							M		M				
Hamtronics, Inc. 65 Moul Rd. Hilton NY 14468	KC						KC	KC		KC		Yes	KC		
Janel Laboratories 33890 Eastgate Circle Corvallis OR 97330					M		M		M				M		
KLM Electronics, Inc. PO Box 816 Morgan Hill CA 95037	M	M							M				M	M	M
Lunar Electronics 2785 Kurtz St., Suite 10 San Diego CA 92110	M	M					M	M		M			M		
Mashna, Inc. PO Box 62 E. Lynn MA 01904			Yes												
Microwave Modules 4800 W. 34th Street Suite D12A Houston TX 77092		M					M	M					M		
Poly Paks PO Box 942 S. Lynnfield MA 01940			Yes									Yes			
Spectrum International PO Box 1084 Concord MA 01742	M	M			M		M	M	M				M		

Legend: K—Kit only; KC—Kit or completed; M—Manufactured (possible minor assembly needed).

Table 3. OSCAR supplier chart (not all inclusive).

It should be remembered that az-el is *not* needed for beginning OSCAR communications; preferably, it should be graduated into as the operator's experience increases.

Power Supplies, or Cut-Rate Juice

Most of the various components mentioned require 12 volts dc at various amperage ranges. Unfortunately, commercial power supplies for anything over two Amps are rather expensive. Depending on the equipment used, two to ten Amps may be required at a time of peak usage.

Probably the cheapest source of power is an old car or motorcycle 12-volt battery. The battery is recharged during periods of nonuse, such as out-of-range periods and overnight. A very good article for a charging regulator to ensure that the battery is not overcharged was in the September, 1980, *73 Magazine*. Of course, this assumes you own a battery charger.

Batteries can be either new or used, including the kind that won't hold a charge for an extended period. These can be used since demand on their power is usually for less than 25 minutes at a time. As mentioned in the *73* article, be sure to allow for adequate ventilation of the battery during charging.

If you operate in or near your garage, you can always run a power cord to your car's battery. You may want to start up the car after usage to make sure the battery didn't run down too far.

Commercial power supplies sometimes can be found cheaply at ham auctions, close-out sales, or occasionally as a loss leader at a ham store. Home-brew power supplies can be built, also.

Coax and Connectors, or The Forgotten Line

Coax and their connectors can be bothersome for satellite communications or VHF/UHF work if some basic facts are not con-

sidered. Briefly stated, the higher the operating frequency, the higher the transmission line loss. With the already weak signal from the satellite received at the antenna, any long runs of cable and use of connectors not designed for VHF/UHF frequencies will wipe out whatever signal was left.

To combat this loss, you need to do some (or all) of the following: Mount the downconverter/upconverter at the antenna; mount the preamp at the antenna; mount these devices in the attic closer to the antenna; don't use a coax grade below RG-8/U; or use hardline if you can't remotely mount the converters at the antenna. Try to use at least BNC or, preferably, N-type connectors if you can afford them. These connectors do not introduce as significant an impedance "bump" (or reduced signal) as do the more conventional PL-259s.

Some potential sources for the more expensive hardline include cable TV companies. There is a definite upswing in cable TV installations around the country; companies may have some coax they would be willing to sell cheaper than their prime stock.

Simply put, the higher the grade or quality of coax and connectors (and the mounting scheme employed), the higher the quality of your received signal. Ask your dealer to show you the specifications on the coax you are contemplating purchasing for your station; he should have them readily available. Also, when making the connections to the coax, take your time and do a good job. For your outside connections, make sure to have good weatherproof connections. The easiest way to do that is spray them with clear lacquer. It's amazing how easily a little corrosion will degrade your signal.

Amplifiers—Needed? Linear or Class C?

Before you purchase an amplifier, be sure you *really* need it for the Phase II satellites. Remember you need only 100 Watts erp to fully and consistently access the satellite. A 10-dB gain antenna with ten Watts into the antenna should more than adequately serve your purposes.

For Phase III, the requirements do increase to 500-1000 Watts erp. Again, you may be able to use precise az-el and a highly-directive (and cheaper) antenna, with only a small increase in needed rf wattage. Remember, the Phase III satellite will not be changing its position in the sky rapidly.

Whatever you decide, many amplifiers have recently hit the market, some as kits and some fully assembled. (See Table 3.) If you are going to operate SSB, be *sure* the amplifier is linear, or you will be able to operate only CW (Class C) or FM terrestrially through it. Some of the nicer amps include a built-in preamplifier.

Remember that the current requirements directly affect your power supply—the higher the power output, the higher the current requirements and the more potentially expensive the power supplies.

Bells and Whistles, or Neat Things

As everyone knows, there can be additions to any operation that make life much easier and more enjoyable. So it is with satellite operations. Digital or other clocks set at UTC make it easier to be consistent with orbital charts. You will need some method of properly telling the correct time, since Phase II satellite operation really is precise to the second; Phase II birds fly by with windows of a maximum of 22 minutes at a time. Phase III will be much more relaxed operationally, since the bird will be visible usually for ten plus hours at a time.

OSCARlocators and similar devices are exceedingly useful and necessary to exactly visualize and track where the birds are: their approximate elevations and azimuths and the associated windows for the time periods of the pass selected. These devices are easy to use and understand and should be part of your operations unless you are computer-controlled. Even then, you would want one for use in visualizing your coverage and respective communication possibilities. They are useful for planning your DX operations, allowing you to see when your windows open up (i.e., such as for Hawaii).

That's one really neat thing about satellite operation: It's really rather predictable, allowing you to set up schedules well in advance, if so desired. Tables for calibration of these devices are reproduced monthly in *QST, 73,* and other monthly amateur publications, and in *Orbit* semimonthly. They also are available on a quarterly basis from Project OSCAR in a very useful individual

Additional Reading

General Information
73 Magazine—July, 1975, and November, 1977. *Orbit* (AMSAT's magazine)—all editions. *QST*—December, 1979, April and May, 1980. *The Radio Amateur's Handbook*, 1980 edition—ARRL. *Satellite Communications*—ARRL

Antenna Construction
Helicals
AMSAT Newsletter—March, 1978, p. 8; June, 1979, p. 20.
Orbit—January/February, 1981, p. 8.
73 Magazine—July, August, September, 1975.
Quads
AMSAT Newsletter—September, 1977, p. 26.
VHF Antenna Handbook, 73.
The ARRL Antenna Book.
Quagis
The ARRL Antenna Book.
Satellite Communications—ARRL.
Polarization—Switchable Sense
AMSAT Newsletter—December, 1978, p. 9. (Note: There is an error in the drawing; the text is correct.)
Turnstiles
73 Magazine—November, 1977, p. 24.
AMSAT Newsletter—March, 1977, p. 3.
Yagis
AMSAT Newsletter—March, 1975, p. 4.
VHF Antenna Handbook, 73.
The ARRL Antenna Handbook.

Amplifiers
AMSAT Newsletter—March, 1977, p. 4.
The Radio Amateur's Handbook—ARRL.

Preamplifiers
AMSAT Newsletter—March, 1973, p. 7 (Mode A); June, 1978, p. 10 (Mode J);
The Radio Amateur's Handbook—ARRL.

Mode J Cavity/Transmitter Filter
Filter: *AMSAT Newsletter*—June, 1978, p. 4.
Cavity: *Satellite Communications*—ARRL.

Varactors and FM Conversions
Tripler: *AMSAT Newsletter*—September, 1976, p. 25.
The Radio Amateur's Handbook—ARRL.
SSB/FM: *AMSAT Newsletter*—December, 1975, p. 10.

Mode J Operation and Equipment
AMSAT Newsletter—September, 1979, p. 18.
Mode J Club— 3300 Fernwood, Alton IL 62002.

orbit and time format for each day's pass.

A large map of the world is a very useful addition, especially if for Phase II satellites you mark the extreme limits of normal communications from your QTH. This marking is especially useful when you notice unusual propagation.

A tape recorder is a nice addition and can help you relive (and possibly verify) some of your more exciting experiences. Any type of recorder is OK, just as long as you can record continuously for 25-30 minutes. The tape recorder is especially useful if you have a desire to tape telemetry and later decode it, or if you have developed a separate receiver for telemetry. Obviously, you will want a tape recorder if you plan any SSTV operation—transmission or reception. The recorder could also be put into use for taping the upcoming SSTV UOSAT weather picture transmissions and other experimental telemetry, and then taking the tape to a friend who has SSTV capability for viewing. Cheap sources of tape recorders are places like GE Service Centers and discount stores.

Speech compressors have received some attention by some authors for use through the satellites. The problem with using such a device is that it puts an undue extra strain on the satellite system, and AMSAT authorities not only do *not* recommend its use, they discourage it.

Weatherproofing of some components such as preamps and converters can be done in some instances by the manufacturer. Where this feature is not available, other effective alternatives exist. Depending on the component's size, old Tupperware™ containers can be placed into service, sealing the openings after insertion of the component and its wiring. Other possibilities include using the Seal-A-Meal™ plastic bags (double sealed), jars (sealing the lids), or simply placing the component in the attic. You can even cut off tops of smaller containers, such as antifreeze containers, resealing them with Super Glue™. Obviously, other alternatives exist as well.

A computer would be the ultimate addition, since it could track the satellite, control your rotors, decode telemetry, and "talk" through the Phase III computer channel.

Operating Aids, or Easy Help

Probably one of the most confusing aspects of your initial satellite operation is the determination of where your uplink signal will be translated into and received on the downlink. Tables 1 and 2 show you approximately, plus or minus Doppler effect, where the downlink should be heard. Be sure to notice that Mode A downlink is not exactly the same for OSCAR 7 and 8, as there is an offset of eight kHz between the two satellites. This is to allow the user to differentiate between the two satellites, as OSCAR 8 catches up with OSCAR 7 every three days due to its lower orbit. If the satellites are in the proper modes (AO-7 in Mode B and AO-8 in any mode), satellite links are possible.

Summary

The world of OSCAR is there just waiting for you. Nothing is quite as exciting as hearing your first satellite telemetry and your first contacts through the satellite. You will have many a fond memory of those occasions.

The station you assemble can be as expensive or as inexpensive as you desire. There's one advantage of slowly building up a station as I did, and that's having the time to review the many various alternatives, products, and ideas of others before actually operating (other than SWLing the downlink).

I hope you can employ some of the ideas given in this article, but no matter which way you go, there is an exciting QSO awaiting you. I also recommend that you contact AMSAT (PO Box 27, Washington DC 20044) and/or the ARRL for more information.

While you're at it, why not throw in a few bucks toward the satellite matching fund, the dollar-for-dollar tax deductable matching fund set up after the demise of Phase IIIA. (See "Phase III Tragedy," *73*, August, 1980, p. 28.) AMSAT has secured a date with the French project Ariane for an operational (not experimental) launch in the spring of 1982—but be sure to check this date from about March on. The effort being made now is to get the spacecraft ready in time for this near-term launch opportunity. When the Phase III satellites are operational, the benefits will be taken for granted in a short time. Predictable, reliable, and effective worldwide operation, depending on the satellite's orbit, will become a reality. And due to be launched before Phase IIIB on September 15, 1981, is the first scientific amateur satellite (UOSAT). This satellite will carry several scientific experiments, SSTV, and propagation beacons which will open up yet another fascinating aspect of our hobby.

I hope you, too, take up the challenge of satellite operations. The thrill never wears off. I hope I hear from you and talk to you soon!■

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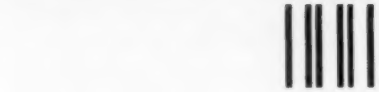

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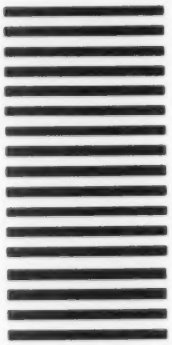

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DX Program Roundup

—for the SWL with DXitis

At last count, there were about 30 DX programs being broadcast in English over the shortwave bands by international broadcasters. Most of these are weekly and some are offered more than once or twice a week. The sheer number of such programs is some indication that station managers either know or believe that shortwave radio listeners like this type of broadcast.

The *World Radio TV Handbook*—the "bible" of the shortwave listening world—defines a DX program as a "broadcast intended for the enthusiasts interested in the various non-programming aspects of radio reception. Covers a wide range of material and can vary from a 3-minute talk on a certain topic to a half-hour magazine program."

This pretty well sums up the content of most of the current DX programs and, by and large, the broadcaster's attempts to produce what the listeners want—up-to-the-minute information on shortwave frequency changes, additions, etc., and any other news that can help or interest the shortwave listener.

Information these programs provide is, of course, only as good as its source. Sources might include the station's own monitoring efforts and those of a commercial monitoring service, such as provided by the British Broadcasting Service. Other important sources are the various DX club bulletins which often are sent to international broadcasters with loggings recorded by their members. And some DX programs receive tips directly from listeners and hasten to put them on the air—with or without confirmation.

Finally, there is, for the less-principled broadcaster, another reliable source of information. This is the material put out on the air by another DX broadcaster. Recently, one of the Iron Curtain DX programs reported the same frequency-change information that had been broadcasted by another European station the week previously!

Just how worthwhile is the information put out by these DX programs? And how many of these broadcasts should the hobbyist who wants to keep abreast of the shortwave radio world listen to each week?

Depending upon an individual's specific interests in shortwave radio listening, I would say that a handful—four or five—of these programs will keep you very well informed. Why just a few?

First of all, if something major in the way of news breaks—such as a big change in broadcast times

Home of the famous DX Juke Box *program.*

or frequencies of the BBC (British Broadcasting Corporation)—just about all of the thirty DX programs on the air will have this news item.

Second, the greater part of the DX program information you will hear each week is really worthless to the average listener. It may be interesting, for example, to hear that a listener in Finland has picked up a station in Siberia on a new frequency, but the chances of the listener in Indiana being able to tune for the same broadcast is very remote.

A third factor is that while all of these DX programs give out information, some of it is rather special in nature and may or may not be of interest.

In rating the DX programs, I would pull some out and say that regardless of your interests, they are so bad that they are not worthwhile tuning for. On the other end of the spectrum are a few programs that are excellent and very worthwhile for every North American listener to tune for each week. Finally, there are the good but primarily special-interest DX programs which some will want very much to hear each week.

I rate five DX programs of the general-interest type as excellent, and I try to monitor at least three of them each week. These are Radio Canada International's *DX Digest*, Radio Netherlands' *DX Juke Box*, Ecuador's HCJB *DX Party Line*, Sweden's *Calling DXers*, and Austria's *Shortwave Panorama*.

Canada's DX Digest

DX Digest is one of the best DX programs on the air. It's on weekly with a half-hour magazine format and has good, solid news and information that you can use. Ian McFarland, the show's host, has been around shortwave radio circles a long time and has put together a program that is made to order for the DXer in North America. First of all, Ian makes sure that his listeners are kept up to date on the latest equipment that hits the market —receivers, antennas, etc. —and has interviews with users or question-and-answer sessions about them. Then, *DX Digest* has Glenn Hauser (a world-known DXer) with the latest in shortwave frequency news. Apart from special interests, you can solve about 90% of your DXing information problems right here on this program.

Listen to it on Saturdays at 2130 GMT on 17.875, 15.325, and 11.945 MHz. On Sundays it is on at 1930 GMT on 11.905 and 15.325 MHz, and on Mondays it is on at 0100 GMT on 11.850 or 5.960 MHz.

Radio Netherlands' DX Juke Box

This old standby of the DX programs has recently undergone a face-lift and the jury is still out as to whether or not they have improved or harmed the show by the changes. The title, *Juke Box*, came from the idea of breaking up the long chain of frequency-change announcements by recorded music—primarily jazz. Before the change in format, they used to devote each weekly program to a particular area of the world. Thus, one week they would have reports from Arthur Cushen in New Zealand, and another week, they'd have reports from the United States by Glenn Hauser, etc. For the listener, it was a very good way to get an idea what was available to pick up from his part of the world.

The new *DX Juke Box* does away with this and has switched to the magazine format with some frequency changes, some questions and answers, and interviews; it has become similar to *DX Digest*. It is still a good program, in my opinion, and worth tuning to each week.

This Johannesburg complex is the home of Radio RSA—the Voice of South Africa. The FM tower is at the left.

Radio Netherlands has a booming signal into the US by virtue of its relay station in Bonaire in the Caribbean. You can hear *DX Juke Box* on Fridays at 0250 GMT on 9.590 and 6.165 MHz. West coast listeners may find it more convenient to tune for it on the same day at 0550 GMT on 6.165 or 9.715 MHz.

Ecuador's HCJB DX Party Line

This religious station is one of the old-time international shortwave broadcasters, and its DX program is also one of the first of its kind. Clayton Howard, the program's host, has been doing this broadcast for many years and has a loyal following. This is principally a "frequency-change" program. The information they give is, however, very accurate and comes from various DX clubs, such as SPEEDX in the US—one of the best of this type of association.

Some listeners complain that the program mixes in too much religion with the DX listings, and if this concerns you, don't listen. For those who don't mind the religious discourses and want up-to-the-minute DX news, you can hear *DX Party Line* easily many times during each week.

On Saturdays, it's on at 0800 GMT on 11.835, 9.760, or 15.235 MHz, and at 2130 GMT on 26.020 or 17.790 MHz. On Sundays, listen at 0230 GMT on 15.155 or 11.915 MHz. Mondays at 0330 GMT it is on 15.155 or 26.020 MHz, at 0800 it's on 11.835 or 9.760 MHz, and at 2130 GMT it's on 21.480 or 17.790 MHz. Tuesdays at 0230 GMT tune in on the

Kol Israel brings you the latest on the Middle East DX scene from Jerusalem.

usual 15.155 or 11.915 MHz. Finally, on Thursdays, at 0230 GMT go to 15.155 or 11.915 MHz, at 0800 GMT to 11.835 or 9.760 MHz, and at 2130 GMT tune in on 21.480 or 17.790 MHz.

Sweden's Calling DXers

This is another old standby and a very solid DX program. The host, George Wood, is an American and knows what we DXers are looking for. George depends a great deal on listeners who send in their rare catches and in return get a weekly summary of the program, which saves tape-recording time and ensures accuracy. You can hear it on Tuesdays at 1415 GMT on 21.615 or 21.700 MHz and at 2315 GMT on 15.380 and 11.705 MHz. On Wednesdays it is at 0245 GMT on 15.315 or 9.695 MHz.

Austria's Shortwave Panorama

This is a relatively new program which has fast become very popular. First of all, it is on the air at a somewhat novel time for DX shows—Sunday mornings. Second, it has recently upgraded itself by signing on Glenn Hauser after he went out of Radio Netherlands when their big changes took place. Listen to this one at 1235 GMT on 21.655 MHz.

More Specialized DXing

So much for the good general-purpose DX shows. I rate the following programs good, too, although they will appeal more to some listeners than others.

South Africa—Radio RSA's *DX Corner.* If you are into DXing the African continent, this is a must program every week. Pieter Martins, the principal engineer of the station, keeps a close watch on broadcasters and their frequencies in all the African countries, including the Third World nations. Last year, I had the privilege of spending a day with Pieter and others of the staff of Radio RSA in Johannesburg, South Africa, and was interviewed for the program during my stay. My impressions of Radio RSA were very good. They have a large staff and the most modern facilities.

You can hear *DX Corner* easily Tuesdays at 1120 GMT on 25.790 MHz, Saturdays at 2140 GMT on 17.795 MHz, and Sundays at 0240 GMT on 9.625, 11.900, or 9.585 MHz.

New Zealand—*NZ Calling.* This is another old favorite, particularly with DXers who are interested in keeping up with broadcasters in the Pacific. Recently, this program has moved up its broadcast time so that it is now on at a decent hour for those of us in the US. Hear it first and third Mondays at 0315 GMT on 17.860 MHz.

Israel—*Calling All Listeners.* This is one for those of you who are interested in keeping up with the Middle East. You can hear it Sundays at 2030 GMT on 15.105, 9.815, or 9.009 MHz and Mondays at 0025 and 0220 GMT on 11.637 or 9.815 MHz.

Switzerland—*Swiss Merry-Go-Round.* Another veteran in DX circles. This one features the "Two Bobs"—Bob Thomann and Bob Zannotti, and its format is the "letter-and-answer" technique. Unlike some DX programs, the questions brought up and answered are not necessarily elementary ones. The two Bobs often wind up in a lively discussion on antennas or some other aspect of the hobby. The program is on only twice a month, on the second and fourth Saturdays at 1320 GMT on 21.570 MHz, at 1535 GMT on 21.570 MHz, and at 2150 GMT on 21.585 or 17.850 MHz. (Later, on Sundays, you can hear it at 0150 GMT on 6.135 and 11.715 MHz.) This is an enjoyable show to hear, and while you won't get many new frequencies to try for from it, you will pick up a good deal of technical knowledge.

Bulgaria—*Radio Sofia.* This is one of the best of the Iron Curtain stations, and its DX program is primarily concerned with information for radio amateurs—news of clubs, some frequency information, etc. Sometimes they hold contests for listeners. Listen to it Fridays at 2135 GMT on 9.665 or 7.115 MHz and Saturdays at 0025 GMT on 15.330 or 9.705 MHz or at 0435 GMT on 7.115 MHz.

The programs reviewed above are the best of the lot—the "Top Ten." There are, of course, others, and while I cannot recommend them, you never can tell when suddenly someone new gets put in charge and you have a winner.

Belgium—*DX Corner.* At present, it is on a kick where it reviews a different international broadcaster, its programs and times of broadcast, etc., each week. Sundays at 1740 GMT on 21.525 or 6.010 MHz; Mondays at 0045 GMT on 11.695 or 15.365 MHz.

Czechoslovakia—*Radio Prague.* While this program

pays particular attention to the radio amateur, the information it gives is very elementary. Recently, they devoted a whole program to telling us what the Morse code requirements were for various Czech licenses. Heard on Fridays at 0135 GMT on 11.990 MHz and at 0335 GMT on 7.345 MHz.

East Germany—*Radio Berlin International.* Not much to offer and not too good a signal at present. Best time seems to be Tuesdays at 0130 GMT on 9.730 MHz.

Hungary—*Radio Budapest.* Tune for this one on 9.835 MHz on Sundays at 0210 and 0310 GMT.

Japan—*Radio Japan.* A brief program of frequency-change announcements; Mondays at 0210 GMT on 21.640 MHz.

Portugal—*Radio Portugal.* Heard at 0310 GMT on 11.925 MHz and at 0510 GMT on 9.575 MHz.

Poland—*Radio Polonia.* Not an easy station to get, but often heard on early Monday mornings—0220 GMT on 15.120 or 7.270 MHz. Not much in the way of DX help, but interesting to hear.

Rumania—*Radio Bucharest.* Listen Saturdays at 0245 GMT on 9.570 MHz.

Spain—*Spanish Foreign Radio.* A few listings. On Mondays at 0050 GMT on 11.880 MHz.

Turkey—*Voice Of Turkey.* What there is pertains to amateurs. Heard on Saturdays at 2100 GMT on 9.725 MHz.

USSR—*Radio Kiev* and *Radio Moscow.* Sometimes the first has interesting material for the radio amateur on Thursdays at 0050 GMT on 15.240, 15.100, and 11.770 MHz.

The other, however, is the worst DX program on the air these days. A typical program tells you all about Greenwich Mean Time or the reasons for radio interference. Easily heard on Sundays at 1320 and 1920 GMT on 17.810. Also assorted other frequencies at the same time.

This pretty well sums up the DX programs heard relatively easily in most parts of the U.S. As you know, these programs come and go. New ones crop up all the time as old ones fade from the air. Recently, a couple of the biggest international broadcasters did away with their DX programs. These were Radio Australia and the BBC.

What causes a station to give up a program like this? Both of these broadcasters have plenty of air time—the BBC is on 24 hours every day. It might be because they think the audience is not interested in DXing, yet in both cases, the shortwave radio world was outspoken in its criticism of these deletions from the air.

More likely is the fact that these broadcasters feel that their audience is changing from a few DXers and radio amateurs to a mass group who have recently purchased multiband portables which easily can bring in the powerhouses like the BBC and Radio Australia. Interestingly enough, the BBC replaced their DX program with one called *Waveguide* which tells all about how to tune in their *own* station better—latest BBC times and frequencies. After all, why devote air time to the competition and *their* times and frequencies when you can use it to make sure the listeners keep tuning into your own programs! ■

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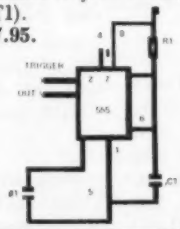

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—automated CW for Level I owners

Its advertisement boasts that it is able to copy Morse code over the air at the unbelievable rate of 100 words per minute and transmit at the same rate, selecting from ten message buffers. Just think! No more frantic searches for scrap paper to jot down the answer to a misshapen CQ!

The only requirement for owning this fantastic ham aid—a Radio Shack TRS-80, Level II microcomputer and possession of more than a few dollars. But being an owner of a Level I, 4K machine *without* more than a few dollars, I began to wonder just what my computer was good for if I couldn't use it in the ham shack?

The answer was to make the Level I just as powerful as the Level II by breaking the BASIC barrier and going to machine-level language. By using just the T-BUG™ Z-80 Monitor and Debugging Aid available from Radio Shack (catalog number 26-2001), I was able to program my microcomputer to send Morse code at a selectable rate and choose between two message buffers each capable of storing 400 ASCII characters. The addition of a programmable peripheral interface (National Semiconductor's 1NS8255) and a tone decoder (Signetics NE567) allowed me to receive code over the QRM and watch as the computer printed the translation in plain English on the video display.

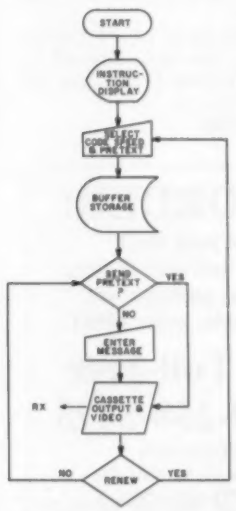

Fig. 1. TX program flowchart.

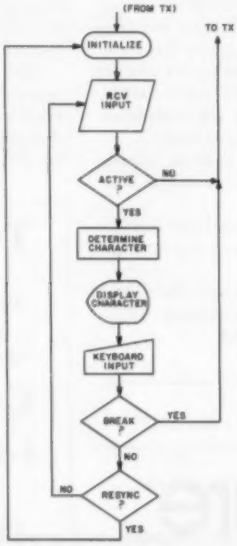

Fig. 2. RX program flowchart.

My system is not as fancy nor as versatile as the commercial product, but it is just as effective and was produced without the expense. (On my budget, $30 qualifies as a few dollars.) This article will show how you, too, may effectively increase the power of your TRS-80 microcomputer and make it talk the international language of Morse code with the bigger machines or with someone with a reasonable fist.

How It Works

The program can be divided into two parts, transmit (TX) and receive (RX). The TX program flowchart, Fig. 1, and RX program flowchart, Fig. 2, outline general operation of the program. TX will output a keyboard-entered message in Morse code through the cassette remote jack of the TRS-80. This portion of the program is detailed in the program listing, Fig. 3. To begin the program, the T-BUG must be loaded and the program tape loaded using the LOAD command and JUMP to 4E01; alternatively, the tape may be loaded using the INITIATE sequence found in the program listing. Initial programming will be done using the T-BUG memory function.

Program execution of START will display the title of the program and instructions as listed in the Instruction Block of Fig. 4. The operator is asked to select the code speed at which he wishes to transmit by entering 1, 2, or 3 from the keyboard, corresponding to 5, 13, or 20 words per minute. (It will be explained later how the program may be changed to adjust the code speed to other than the mentioned speeds.) According to the code speed input,

Fig. 3. Program listing.

```
ADDRESS  CODE      STATEMENT          REMARK

INITIATE
4E5Ø     CDF4ØE    CALL LOAD          ;T-Bug Command
   83    C3Ø14E    JP START
START
4E81     21ØØ4E   LD HL, Instruction Block
   84     7E       LD A (HL)          ;Loop
   85     D7       RST 1Ø             ;Print Instruction
   86     2B       DEC HL
   87     FEFF     CMP FF
   89     CA8F4E   JP Z, SELECT SPEED ;End Instruction
   8C     C3Ø44E   JP Loop
   8F     CD4ØØB   CALL CHKIO         ;SELECT SPEED
   12     28FB     JR Z,-5
   14     57       LD D, A            ;Store Selection
   15     FE31     CMP 1              ; 5 WPM?
   17     CA264E   JP Z,  5 WPM
   1A     7A       LD A, D
   1B     FE32     CMP 2              ;13 WPM?
   1D     CA2E4E   JP Z, 13 WPM
   2Ø     7A       LD A, D
   21     FE33     CMP 3              ;2Ø WPM?
   23     CA364E   JP Z, 2Ø WPM
5 WPM
4E26     3E1F     LD A, 5 WPM Factor
   28     326147   LD FACTOR, A
   2B     C33B4E   JP PRETEXT ENTRY INSTRUCTION
13 WPM
4E2E     3E04     LD A, 13 WPM Factor
   3Ø     326147   LD FACTOR, A
   33     C33B4E   JP PRETEXT ENTRY INSTRUCTION
2Ø WPM
4E36     3E02     LD A, 2Ø WPM Factor
   38     326147   LD FACTOR, A
PRETEXT ENTRY INSTRUCTION
4E3B     7E       LD A (HL)          ;Instruction Block Loop
   3C     D7       RST 10             ;Print Instruction
   3D     2B       DEC HL
   3E     FEFF     CMP FF             ;End Instruction
   41     CA464E   JP Z, PRETEXT LOAD
   43     C33B4E   JP Loop
PRETEXT LOAD
   46     21FD49   LD HL, Pretext Buffer
   49     CD7Ø47   CALL WRITE
   4C     36FF     LD HL, FF          ;End Of Pretext
   4E     C34444   JP RX              ;Sample Input And Decode
RX
4444     3E00     LD A, Ø            ;Initialize Variables
   46     321E44   LD Code Register, A
   49     321544   LD Character Flag, A
   4C     3E08     LD A, Ø8           ;Initialize
   4E     321644   LD Character Register, A
   51     321744   LD Character Register, A
   54     3E0E     LD A, ØE           ;Initialize
 4456     321A44   LD Dot-time, A
   59     321B44   LD Dot-time, A
   5C     31FD43   LD SP, 43FD
   5F     C38Ø45   JP STATUS
STATUS
4580     CD6Ø46   CALL SCAN              ;Keyboard Control
   83     CD9Ø47   CALL SKEY              ;Sample Input Status
   86     79       LD A, Status
   87     FE8Ø     CMP 8Ø                 ;Key Down?
   89     CA9Ø46   JP Z, DOWN
UP
45A0     26ØØ     LD H,ØØ                ;Reset Uptime Counter
   A2     2EØØ     LD L,ØØ
   A4     221844   LD Uptime, HL          ;Reset Uptime Register
   A7     2A1844   LD HL, Uptime          ;Uptime Loop
   AA     23       INC HL
   AB     221844   LD Uptime, HL          ;Store Uptime
   AE     CD9Ø47   CALL SKEY              ;Look For Status Change
   B1     7C       LD A, H
   B2     FEFF     CMP FF                 ;Key Inactive?
   B4     CA2D47   JP Z, LAST LETTER      ;Print Last Letter
   B7     3EØØ     LD A, ØØ
   B9     B9       CMP C                  ;Key Up?
   BA     CAA745   JP Z, Loop
   BD     2A1644   LD HL, Character Space
   C0     29       ADD HL, HL
   C1     ED4B1844 LD BC, Uptime
   C5     ED42     SBC HL, BC
   C7     FA9Ø46   JP M, DECODE           ;Word Formed
CA-CF     ØØ       NOP
   D0     ED4B1844 LD BC, Uptime
   D4     ED42     SBC HL, BC
   D6     3E01     LD A, Ø1
   D8     321544   LD Character Flag, A
   DB     FA9Ø46   JP M, DECODE           ;Letter Formed
   DE     3EØØ     LD A, ØØ
   E0     321544   LD Character Flag, A ;Letter Incomplete
   E3     2A1844   LD HL, Uptime
   E6     29       ADD HL, HL
   E7     221644   LD Character Space, HL;Character Space=Uptime
   EA     C38Ø45   JP STATUS              ;Complete Letter
DOWN
46ØØ     26ØØ     LD H, ØØ               ;Reset Downtime Counter
   02     2EØØ     LD L, ØØ
   04     221C44   LD Downtime, HL        ;Reset Downtime Register
   07     2A1C44   LD HL, Downtime        ;Downtime Loop
   0A     23       INC HL
   0B     221C44   LD Downtime, HL        ;Store Downtime
   0E     CD9Ø47   CALL SKEY              ;Look For Status Change
   11     3E8Ø     LD A, 8Ø
   13     B9       CMP C                  ;Key Down?
   14     CA4746   JP Z, Loop
   17     2A1A44   LD HL, Dot-time
   1A     CB3E     SRL(HL)
   1C     ED4B1A44 LD BC, Dot-time
   2Ø     Ø9       ADD HL, BC
   21     ED4B1C44 LD BC, Downtime
   25     ED42     SBC HL, BC
 4627     F23Ø46   JP M, DOT              ;Character Dot
   2A     C35Ø46   JP DASH                ;Character Dash
DOT
4630     2A1C44   LD HL, Downtime
   33     221A44   LD Dot-time, HL        ;Dot-time=Downtime
   36     3A1E44   LD A, Code Register;Get Code
   39     CB27     SLA A                  ;Shift Code
   3B     C6Ø1     ADD Ø1                 ;Add Dot To Code
   3D     321E44   LD Code Register, A;Store Code
   4Ø     C38Ø45   JP STATUS              ;Get Rest Of Letter
DASH
465Ø     3A1E44   LD A, Code Register;Get Code
   53     CB27     SLA A                  ;Shift Code
   55     C6Ø2     ADD Ø2                 ;Add Dash To Code
   57     321E44   LD Code Register, A;Store Code
   5A     C38Ø45   JP STATUS              ;Get Rest Of Letter
DECODE
469Ø     215A45   LD HL, MX Character Search Table
   93     3A1E44   LD A, Code Register;Get Code
   96     Ø13BØØ   LD BC, Search Ø
   99     EDB9     CPDR                   ;Search Table
   9B     7D       LD A, L
   9C     C6Ø1     ADD Ø1                 ;Adjust HL For Match
   9E     D7       RST 1Ø                 ;Print Letter
   9F     3A1544   LD A, Character Flag
   A2     FEØ1     CMP Ø1                 ;Letter?
   A4     3EØØ     LD A, Ø
   A6     321544   LD Character Flag, A;Reset Character Flag
   A9     321E44   LD Code Register, A;Reset Code Register
   AC     3E2Ø     LD A, 2Ø
   AE     D7       RST 1Ø                 ;Space
   AF     CA8Ø45   JP Z, STATUS           ;Get Next Letter
   B2     D7       RST 1Ø                 ;Space Word
   B3     D7       RST 1Ø
   B4     C38Ø45   JP STATUS              ;Get Next Letter
LAST LETTER
472D     215A45   LD HL, MX Character Search Table
   3Ø     3A1E44   LD A, Code Register;Get Code
   33     Ø13BØØ   LD BC, Search Ø
   36     EDB9     CPDR                   ;Search Table
   38     7D       LD A, L
   39     C6Ø1     ADD A, Ø1              ;Adjust HL For Match
   3B     D7       RST 1Ø                 ;Print Letter
   3C     3E0D     LD A, ØD
   3E     D7       RST 1Ø                 ;Advance Cursor
TX
474Ø     3EØØ     LD A, ØØ               ;Initialize
   42     321C44   LD Delay Base (L), A
45-49     ØØ       NOP
   4A     321244   LD Dot Flag, A
4D-4F     ØØ       NOP
   5Ø     321Ø44   LD Buffer Register(L), A
   53     3E4D     LD A, 4D
   55     321144   LD Buffer Register(H), A
4758     2A1Ø44   LD HL, Buffer Register; Initial Buffer
   5B     3EF9     LD A, F9
   5D     321D44   LD Delay Base(H), A;Initialize Speed Base
   6Ø     3E(Ø2)   LD A, WPM Factor       ;Factor From SELECT
   62     322Ø44   LD Delay(L), A
   65     322144   LD Delay(H), A
   68     CD7Ø47   CALL WRITE             ;Enter Message
   6B     36FF     LD(HL), FF             ;Mark End Of Message
   6D     C3A847   JP ENCODE
ENCODE
47A8     2A1Ø44   LD HL, Buffer
   A3     221344   LD Buffer Location, HL
   A6     11FF49   LD DE, TX Character Search Table;BUFFER SEARCH
   A9     2A1344   LD HL, Buffer Location
   AC     7E       LD A, (HL)             ;Buffer Letter
   AD     2B       DEC HL                 ;Go To Next Letter
   AE     221344   LD Buffer Location, HL;Store Location
   B1     47       LD B, Letter           ;Store Letter
   B2     FEFF     CMP FF                 ;End Of Text?
   B4     CA4444   JP Z, RX               ;Sample Input
   B7     1A       LD A, (DE)             ;TABLE SEARCH
   B8     B8       CMP B                  ;Table Match Letter?
   B9     CAD047   JP Z, BIT TEST
   BC     13       INC DE
   BD     13       INC DE                 ;Adjust Table
   BE     C3B747   JP TABLE SEARCH
BIT TEST
47D0     13       INC DE                 ;Locate Code
   D1     1A       LD A, Code
   D2     57       LD D, A                ;Store Code
   D3     FEFE     CMP FE                 ;Space?
   D5     CA9Ø4B   JP Z, WORD SPACE
   D8     CB7A     BIT 7, D               ;First Character
   DA     CD514A   CALL SEND              ;Morse Code Out
   DD     7B       LD A, E                ;Get Letter Group
   DE     DE03     SUB Ø3                 ;1 Character Group?
   E0     FA3Ø4B   JP M, LETTER SPACE
   E3     CB72     BIT 6, D               ;Second Character
   E5     CD514A   CALL SEND              ;Morse Code Out
   E8     7B       LD A, E                ;Get Letter Group
   E9     DE0B     SUB ØB                 ;2 Character Group?
   EB     FA3Ø4B   JP M, LETTER SPACE
   EE     CB6A     BIT 5, D               ;Third Character
   F0     CD514A   CALL SEND              ;Morse Code Out
   F3     7B       LD A, E                ;Get Letter Group
   F4     DE1B     SUB 1B                 ;3 Character Group?
   F6     FA3Ø4B   JP M, LETTER SPACE
   F9     CB62     BIT 4, D               ;Fourth Character
   FB     CD514A   CALL SEND              ;Morse Code Out
   FE     7B       LD A, E                ;Get Character Group
   FF     DE33     SUB 33                 ;4 Character Group?
4801     FA3Ø4B   JP M, LETTER SPACE
   Ø4     CB5A     BIT 3, D               ;Fifth Character
   Ø6     CD514A   CALL SEND              ;Morse Code Out
   Ø9     7B       LD A, E                ;Get Character Group
   ØA     DE49     SUB 49                 ;5 Character Group?
   ØC     FA3Ø4B   JP M, LETTER SPACE
481Ø     CB52     BIT 2, D               ;Sixth Character
   11     CD514A   CALL SEND              ;Morse Code Out
   14     C3Ø4B    JP LETTER SPACE
WORD SPACE
4B9Ø     CD7Ø4E   CALL DELAY             ;Word Space Delay
   93     CD7Ø4E   CALL DELAY
   96     CD7Ø4E   CALL DELAY
   99     CD7Ø4E   CALL DELAY
   9C     3E2Ø     LD A, Space
   9E     D7       RST 1Ø
```

Continued

Program listing, continued.

```
                D7          RST 10          ;Print Space
                D7          RST 10          ;Print Space
                C3A647      JP BUFFER SEARCH ;Complete Text
LETTER SPACE
                CD704E      CALL DELAY      ;Letter Space Delay
                CD704E      CALL DELAY
                3E20        LD A, Space
                D7          RST 10          ;Print Space
                C3A647      JP BUFFER SEARCH ;Complete Text

                            SUBPROGRAM LISTING

SCAN
                CD400B      CALL CHKIO      ;Sample Keyboard
                47          LD B, Letter    ;Store Letter
                FE03        CMP BREAK       ;BREAK Key?
                CA814E      JP Z, TX
                78          LD A, Letter
                FE1E        CMP Resync      ; → Key?
                C8          RET NZ
                C34444      JP RX           ;Resync Counters
SKEY
                DB00        IN A, Key       ;Sample Input
                CB47        BIT 0, A        ;Test Bit 0 of Input
                C2A047      JP NZ, Key Down ;Key Down?
                0E00        LD C, 00        ;Key Up
                C9          RET
                0E80        LD C, 80        ;Key Down
                C9          RET
WRITE
                CD400B      CALL CHKIO      ;Sample Keyboard Loop
                28FB        JR Z, Loop
                57          LD D, Letter
                FE0D        CMP ENTER       ;Text Complete?
                C8          RET Z           ;Text Ready
                7A          LD A, Letter    ;Recall Letter
                FE1D        CMP Backspace   ; ← Key?
                CABE47      JP Z, ERROR
                7A          LD A, Letter    ;Recall Letter
                FE1B        CMP Scroll      ;Video Line Full?
                CABE47      JP Z, ERROR
                7A          LD A, Letter    ;Recall Letter
                FE23        CMP #           ;Send Pretext?
                C29247      JP Z, PRETEXT
                C3A44D      JP BUFFER FULL
                23          INC HL          ;ERROR, Adjust
                C37047      JP Loop
                21FD49      LD HL, Pretext  ;PRETEXT
                221A44      LD Buffer, Pretext Buffer
                23          INC HL          ;Reset Buffer
                C9          RET
BUFFER FULL
                7E          LD A, Buffer Content
                FE7E        CMP 7E          ;End Of Buffer?
                CA164D      JP Z, ADJUST
                7A          LD A, Letter    ;Recall Letter
                72          LD (HL), Letter ;Write Letter
                2B          DEC Buffer
                C37047      JP Loop
                23          INC Buffer      ;ADJUST
                C9          RET
SEND
                CD644A      CALL CASSETTE ON
                2803        JR Z, +5        ;Bit Dot?
                CD704A      CALL DASH DELAY
                CD824A      CALL DOT DELAY
                3E00        LD A, 00        ;CASSETTE OFF
                D3FF        OUT Cassette    ;Turn Cassette Off
                C9          RET
CASSETTE ON
                3E04        LD A, 04
                D3FF        OUT Cassette    ;Turn Cassette On
DASH DELAY
                CD704E      CALL DELAY
                CD704E      CALL DELAY      ;Leave Cassette On For Dash
                3E01        LD A, 01
                321244      LD Dot Flag, A  ;Store Character Type
                C9          RET
DOT DELAY
                CD704E      CALL DELAY      ;Leave Cassette On For Dot
                3A1244      LD A, Dot Flag
                FE01        CMP 01          ;Character Dash?
                2005        JR NZ, +7
                3E2D        LD A, Dash Graphic
                D7          RST 10          ;Print  Dash
                1803        JR +5           ;Jump
                3E2E        LD A, Dot Graphic
                D7          RST 10          ;Print Dot
                CD5C4A      CALL CASSETTE OFF
                CD704E      CALL DELAY      ;Wait For Next Character
                3E20        LD A, Space
                D7          RST 10          ;Space Video Characters
                3E00        LD A, 0
                321244      LD Dot Flag, A  ;Reset Dot Flag
                A2          RET
DELAY
                ED4B1C44    LD BC, Delay Base
                2A2044      LD HL, Delay    ;Loop
                ED42        SBC HL, BC
                03          INC BC
                7A          JR Z, Loop
                C9          RET
```

the wpm factor is established. The function of this and other variables subsequently used is described in Fig. 5.

Immediately upon making the selection of code speed, program execution is passed to PRETEXT ENTRY INSTRUCTION which prints "PRETEXT:" from data located in the Instruction Block. Up to 488 characters or seven video lines may then be entered from the keyboard under control of PRETEXT LOAD and stored in the Pretext Buffer occupying memory locations specified in the Memory Map of Fig. 6. Text stored in the Pretext Buffer is protected for repeated use and requires a restart of the TX program to change, but may be called for at any time.

PRETEXT LOAD writes text into the Pretext Buffer by the WRITE subroutine. All alphanumeric characters plus punctuation (, . ? / and space) are supported. Corrections to the text as it is being written may be made by using the backspace key on the keyboard. The backspace key also permits retention of the previously entered pretext if the backspace key is depressed when "PRETEXT:" appears and the ENTER key is then depressed. A summary of the keyboard control key functions is listed in Fig. 7.

When the text is complete, the ENTER key is depressed, setting a flag (FF) to mark the end of the text in the buffer, and the program jumps to RX. RX will decode a Morse code signal present at port A as outlined in Fig. 2. (A more detailed description of this portion of the program will follow.) If the input from RX is inactive for six seconds, the program returns to TX, where initialization occurs. The WRITE subroutine permits the setting of the Buffer Register to the Pretext Buffer if the # key is pressed, at which point the program goes to ENCODE; otherwise, it enters the text into the Message Buffer (see Fig. 6) similar to that described for the Pretext Buffer above. Previously entered text in the Message Buffer may be saved using the same procedure outlined above by using the backspace key and ENTER. A total of 397 characters or 6¼ video lines are permitted in the Message Buffer before becoming full and passing to ENCODE.

Upon completing the text, depressing ENTER marks the end of text and the program goes to ENCODE. ENCODE reads the Buffer Register which has been established as the Message or Pretext Buffer by WRITE. Each character of the buffer is read by BUFFER SEARCH. The letter in the buffer is matched with the code found in the TX Character Search Table (see Fig. 8) by BANK SEARCH. If the letter is the end of the text (FF) the program goes to RX. (This can be used to enter RX directly with no message by depressing ENTER. The Message Buffer text will be lost by using this method of reentering the RX program). If the letter is other than FF, BIT TEST determines how many characters are in the letter by testing the letter's position in the table. Each sequential character is determined to be a dot or dash from the code. This character information is processed by SEND, which turns the cassette remote jack on by CASSETTE ON. The program then branches to the appropriate DOT DELAY or DASH DELAY.

In the two subroutines, the cassette jack is left on for the wpm factor selected earlier. This factor is used in determining the minimum cassette-on time in the subroutine DELAY, based upon the Delay Base and Delay Register as described in Fig. 5. The dash is three times as long as the dot. The character type sent is stored in the Dot Flag (see Fig. 5) to determine the Morse code graphic character to be printed in DOT DELAY. DOT DELAY turns the cassette remote jack off by CASSETTE OFF and delays the program the length of a dot before getting the next character of the letter, or

going to LETTER SPACE if the letter has been completed as determined by BIT TEST. LETTER SPACE delays the program for the length of one dash before proceeding to BUFFER SEARCH to get the next letter. If the letter is a space (FE), the program executes WORD SPACE and is delayed the length of seven dots before getting the next letter from BUFFER SEARCH.

Code speeds other than those provided for in the program can be obtained by changing the Delay Base Register. By changing the contents of 475C to any value between F5 and FE, a wide range of speeds can be obtained. Let trial and error be the guide. The relative code speed selection (5, 13, and 20 wpm) is determined by the wpm factor. This can be adjusted by changing the value of addresses 4E27, 4E2F, and 4E37. After determining the newly adjusted wpm value, changing the values of addresses 4DAE, 4DA4 and 4DA3, and 4D99 and 4D98 to correspond to the ASCII code of the new first, second, and third selections will print the new selections from the Instruction Block.

The receive portion of the program (RX) depends solely on the interpretation and timing of ON and OFF inputs representing Morse code characters. The initialization of RX provides for rapid synchronization of the variables to the ON-OFF input states. If timing is awry, resynchronization must be accomplished by reinitializing.

After initializing, the program proceeds to STATUS where the operator may, through the SCAN subroutine, command a jump back to START and TX by depressing the BREAK key, or resynchronization may be accomplished using the → key (see Fig. 7). With no keyboard entry, the program goes to the SKEY subroutine. The SKEY tests the input and determines whether it is ON (key down) or OFF (key up), returning the status as 80 or 00, respectively. Based on the status, the program jumps to DOWN or UP.

In the UP routine, the time the key is up is established and stored in the Uptime Register (see Fig. 5). If it is up for more than six seconds, the input is considered inactive and the program prints the last letter received in LAST LETTER and then proceeds to TX. If the status changes to key down within six seconds, the Uptime is compared to twice that of the Character Space. If Uptime is greater than twice the Character Space, a word has been received and the program goes to DECODE. If Uptime is less than twice the Character Space, it is compared to the Character Space. If Uptime is greater than Character Space, a letter has been received which sets the Character Flag and the program jumps to DECODE. If the Uptime is less than Character Space, it is doubled and becomes the new Character Space. The program then branches back to STATUS to verify that a key-down status exists.

The Downtime is compared to 1½ times the Dot-time (see Fig. 5). If Downtime is less than 1½ times Dot-time, a dot has been received; otherwise, it is a dash. If the character is a dot, DOT sets the Downtime equal to the Dot-time and the Code Register is shifted to add 01. The program then jumps back to STATUS to get the next character. If the character was a dash, the Code Register is shifted and 02 added. The program then jumps to STATUS.

DECODE is entered only when it is determined that a letter or word has been

ADDRESS	DATA	ADDRESS	DATA
4D7F	FF	4DB3	3A
80	20	B4	4E
81	3A	B5	4F
82	54	B6	49
83	58	B7	54
84	45	B8	43
85	54	B9	45
86	45	BA	4C
87	52	BB	45
88	50	BC	53
89	20	BD	20
8A	52	BE	44
8B	45	BF	45
8C	54	C0	45
8D	4E	C1	50
8E	45	C2	53
8F	0C	C3	20
90	F7	C4	45
91	20	C5	44
92	3F	C6	4F
93	20	C7	43
94	4D	C8	20
95	50	C9	52
96	57	CA	45
97	20	CB	54
98	30	CC	4E
99	32	CD	45
9A	20	CE	0D
9B	29	CF	53
9C	33	D0	4E
9D	20	D1	57
9E	20	D2	4F
9F	4D	D3	44
A0	50	D4	20
A1	57	D5	2E
A2	20	D6	44
A3	33	D7	20
A4	31	D8	59
A5	20	D9	42
A6	29	DA	20
A7	32	DB	4B
A8	20	DC	34
A9	20	DD	20
AA	4D	DE	49
AB	50	DF	20
AC	57	E0	4C
AD	20	E1	45
AE	35	E2	56
AF	20	E3	45
B0	29	E4	4C
B1	31	E5	20
B2	20	E6	30
E7	38	F4	53
E8	2D	F5	52
E9	53	F6	4F
EA	52	F7	4D
EB	54	F8	20
EC	20	F9	58
ED	2C	FA	52
EE	45	FB	20
EF	44	FC	26
F0	4F	FD	20
F1	43	FE	59
F2	20	FF	54
F3	45	4E00	0C
4817	FE	4E4E	FE

Fig. 4. Instruction block.

REGISTER	TITLE	FUNCTION
4410 11	Buffer Register	Contains address of currently used message or pretext storage buffer.
4412	Dot Flag	Set if character sent is dash to determine graphic character.
4413 14	Buffer Location Register	Contains current buffer address during TX table search.
4415	Character Flag	Identifies received character as an incomplete letter if reset.
4416 17	Character Space Register	Determines minimum time between received characters.
4418 19	Uptime Counter	Contains count between received characters.
441A 1B	Dot-time Register	Determines duration of shortest received character.
441C 1D	Downtime Counter/ Delay Base	Contains duration of current received character/Establishes code speed for transmitted character.
441E	Code Register	Contains received characters making up letter.
4420 21	Delay Register	Determines transmitted character duration.
4761	WPM Factor	Internally adjusts Delay Base.

Fig. 5. Program variables.

ADDRESS	CONTENTS
0000 - 39FF	Level I ROM
4000 - 43FF	T-Bug
4520 - 455A	RX Character Search Table
4818 - 49FD	Pretext Buffer
49FF - 4A50	TX Character Search Table
4B4F - 4D00	Message Buffer
4DFF - 4E00	Instruction Block

Fig. 6. Program memory map.

KEY	DESCRIPTION
BREAK	Program restarted to allow reselection of code speed and pretext entry.
←	Backspace will protect previously entered text in Buffer if depressed initially and ENTER. Also allows correction of text by erasing incorrectly entered text.
→	RX program reinitiated to allow proper timing.
ø	Transmits message in pretext.
ENTER	Indicates end of text and allows transmission of text in message buffer.
SPACEBAR	Enters blank space in text.

Fig. 7. Keyboard functions.

ADDRESS	DATA	ASCII
49FF	45	E
4A00	00	
01	54	T
02	80	
03	41	A
04	40	
05	49	I
06	00	
07	4D	M
08	C0	
09	4E	N
0A	00	
0B	44	D
0C	80	
0D	47	G
0E	C0	
0F	4B	K
10	A0	
11	4F	O
12	E0	
13	52	R
14	40	
15	53	S
16	00	
17	55	U
18	20	
19	57	W
1A	60	
1B	42	B
1C	80	
1D	43	C
1E	A0	
1F	46	F
20	20	
21	48	H
22	00	
23	4A	J
24	70	
25	4C	L
26	40	
27	50	P
28	60	
29	51	Q
2A	D0	
2B	56	V
2C	10	
2D	58	X
2E	90	
2F	59	Y
30	E0	
31	5A	Z
32	60	
33	31	1
34	78	
35	32	2
36	38	
37	33	3
38	18	
39	34	4
3A	08	
3B	35	5
3C	00	
3D	36	6
3E	80	
3F	37	7
40	C0	
41	38	8
42	20	
43	39	9
44	70	
45	30	0
46	70	
47	2F	/
48	90	
49	2C	,
4A	CC	
4B	3F	?
4C	30	
4D	20	SPACE
4E	FE	
4F	2E	.
50	54	

Fig. 8. TX character search table.

formed. DECODE takes the letter formed in the Code Register and matches it with the code contained in the RX Character Search Table of Fig. 9. The corresponding ASCII code (* for error) then is printed on the video display after the appropriate letter or word space has been printed from a test of the Character Flag. The program then jumps back to STATUS to get the next character.

ADDRESS	DATA	ASCII
4520	00	SPACE
21	01	
↓	↓	
29	01	
2A	FF	*(ERROR)
2B	01	
2C	72	,
2D	01	
2E	54	.
2F	31	/
30	3E	0
31	2E	1
32	26	2
33	12	3
34	20	4
35	1F	5
36	2F	6
37	37	7
38	3B	8
39	3D	9
3A	01	
↓	↓	
3E	01	
3F	4B	?
40	01	
41	04	A
42	17	B
43	19	C
44	0B	D
45	01	E
46	11	F
47	0D	G
48	0F	H
49	03	I
4A	16	J
4B	0C	K
4C	13	L
4D	06	M
4E	05	N
4F	0E	O
50	15	P
51	1C	Q
52	09	R
53	07	S
54	02	T
55	08	U
56	1D	V
57	0A	W
58	18	X
59	1A	Y
5A	1B	Z

Fig. 9. RX character search table.

Interfacing and Operating

The RX portion of this program requires the addition of an interface and tone decoder or key as shown in Fig. 10. Construction of these circuits is not critical. Breadboarding is acceptable; masking of the input is required to prevent false states, however. The 1NS8255 is a little more than needed but permits adding additional ports to three eight-bit ports. Only the 0-bit A port is used in this program. The nice thing about this chip is the pin-for-pin compatibility with the TRS-80 expansion port. The +5-V power supply of the chip (pin 26) can be connected to the microcomputer's +5-V output on pin 39 of the expansion port edge card. Level II does not have +5 V on this pin; a separate power supply will therefore be necessary. Three 16-pin DIP shunt jumpers were used with the expansion port card edge connector (AMP P/N 88103-1) to tie into the interface. The interface was mounted on a PC board and housed neatly in a Kitchen Maid plastic utility tray that fits nicely beneath the keyboard. The tone decoder cannot be placed near the computer because of logic switching noise getting into the detection circuit.

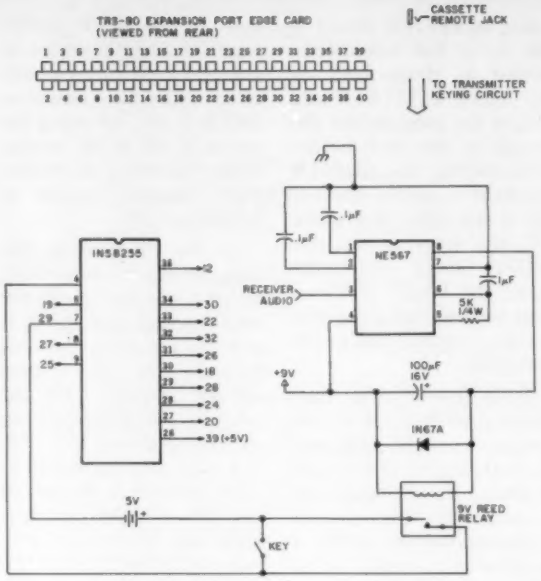

Fig. 10. Hardware schematic.

This system has performed without difficulty for over six months. I have used it to generate code tapes used in teaching Morse code to Novices and have had excellent comments from the students. Over the air, I have never sounded so good. My usual, sloppy fist is now letter perfect. Morse code has been received with perfect copy at 35 wpm from W1AW. A few operating hints follow to permit the user a full appreciation of the system's capabilities.

Transmitter keying is not done directly with the cassette remote jack but through a keyer. This is done to protect the cassette relay's contacts. Weak or fading signals do cause timing problems as the signal is lost; resynchronization will correct the improper timing, however, once the signal is regained. Erratic code speed will likewise cause improper timing requiring resynchronization. The need to resynchronize is seen by the improper generation of letters or no generation on the video display.

Attempts to overcome signal loss by increasing the audio level causes overloading of the NE567, resulting in lockup. Noise or QRM can be filtered out quite effectively through use of the receiver's clarifier which also adjusts the signal's audio tone to put the tone into the detection band of the NE567. Difficulty has been experienced when noise from the high speed logic circuits of the computer are picked up by the receiver resulting in rampant generation of characters across the screen as the computer listens to itself. This is prevented by operating elsewhere on the band where the computer is not as noisy. Excessive RFI from the transmitter does affect the video display but does not interfere with the completion of the TX program.

Level II users may have noticed that their keyboard input and memory map are not compatible with the program. By calling their own keyboard subroutine and reassigning memory, Level II users may adapt the program.

If you are as lazy as I am, I am sure you will find the use of the TRS-80 a great way to just sit back and let the machine do the work. With the addition of the interface, the capabilities of your machine will be improved greatly. The whole outside world awaits—I may even figure out how to turn my coffee pot on.

I wish to thank Laris Pickett WB0QNT for his technical advice on the use of the cassette remote jack and John Engel WA0LPV for his support and suggestions in developing this program. ■

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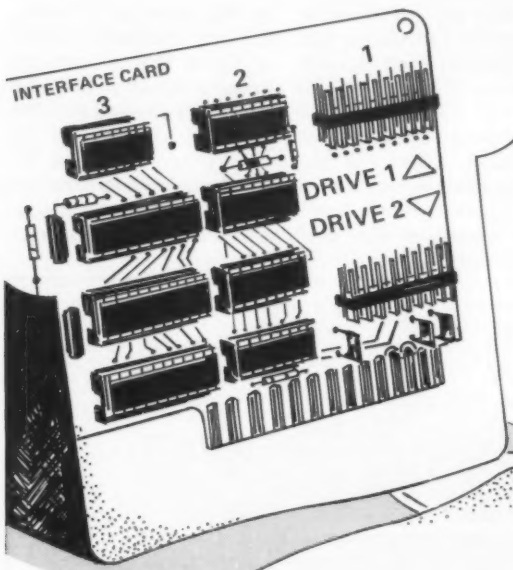

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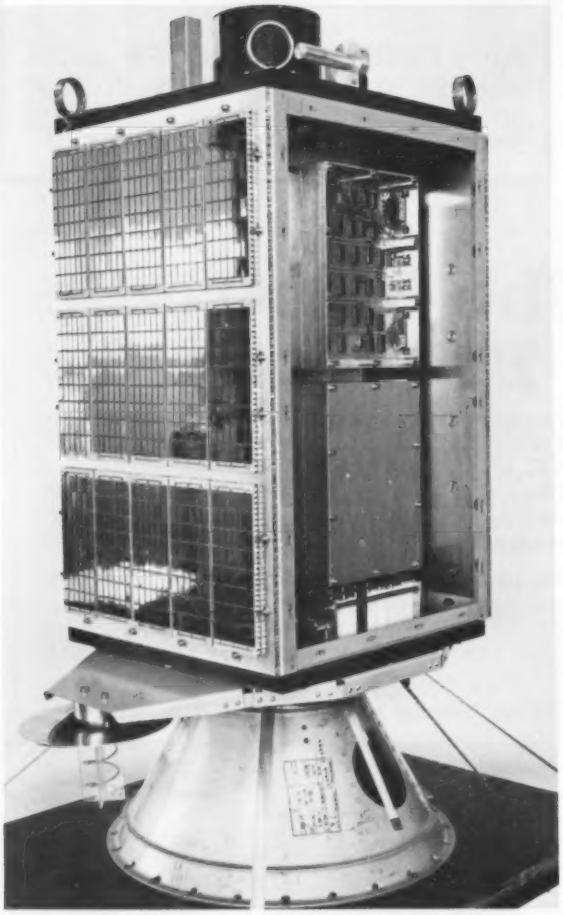


UoSAT, an amateur satellite built in the United Kingdom, will give experimenters a chance to receive pictures from a slow-scan TV camera pointed towards the Earth. The spacecraft also features beacons on two meters and 70 cm, as well as provisions for HF and microwave propagation experiments.

May 23, 1980, is known as Black Friday among amateur radio satellite enthusiasts. At 1430 GMT on that fateful day, the rocket carrying amateur radio's most ambitious spacecraft yet failed shortly after launch, sending Phase IIIA to a watery grave. One year later, hams still remember the tragedy, but they are not defeated by it. Building from the ruin and despair that accompanied the loss of Phase IIIA, the amateur satellite community has even more ambitious plans for the future. Through persistence and loyalty, these hams have organized the construction and launch of two satellites in the next year.

UoSAT

An early September, 1981, launch is scheduled for UoSAT, an amateur scientific and educational spacecraft conceived and constructed by radio enthusiasts from the United Kingdom. UoSAT is sponsored by the University of Surrey, AMSAT, the Radio Society of Great Britain, and the British Industry and Research Organization. The mission objectives for UoSAT represent an attempt to provide a means for analyzing radio propagation and satellite teleme-

BIRTH OF A SATELLITE SYSTEM

December 12, 1981, will mark the 20th anniversary of amateur radio's first satellite. The Orbiting Satellite Carrying Amateur Radio, OSCAR 1, circled the Earth transmitting the greeting "HI" in Morse code. This battery-powered spacecraft weighed a mere 10 pounds and cost about $65.00 to build.

We have come a long way since the days of OSCAR 1. In 1969, the Radio Amateur Satellite Corporation (AMSAT) was founded. Now in its second decade, AMSAT provides the coordination and support that makes the amateur satellite program possible. Hundreds of hams have committed their energy and resources towards the world's only "amateur" satellites. They have built, launched, and controlled eight satellites for a fraction of the commercial cost.

The success of amateur radio's satellites is directly linked to the support individual hams provide. *73 Magazine* urges you to join AMSAT. They offer a bimonthly magazine, *Orbit*, and a biweekly newsletter, *AMSAT Satellite Report*, full of information about the latest satellite developments. Write to AMSAT, PO Box 27, Washington DC 20044, or call (202)-589-6062.

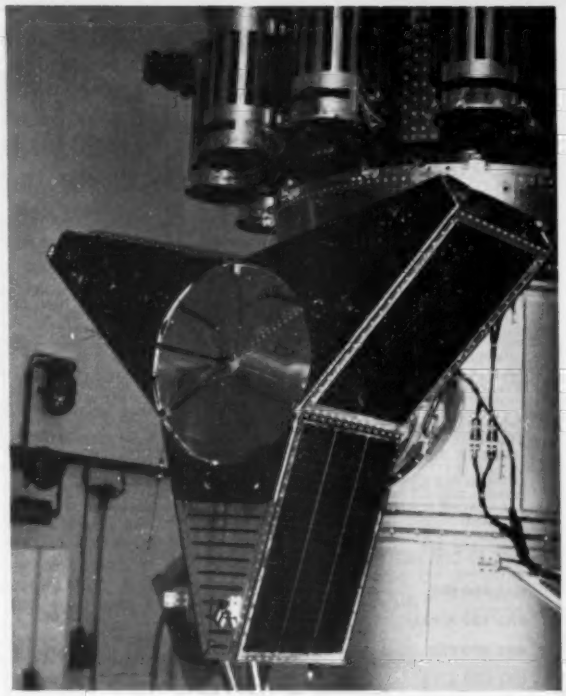
try from HF to microwave frequencies. The thrust of the UoSAT craft will be to develop experimental skills rather than relaying communications, so all of the satellite's functions will be "one way" (i.e., listen-only) for amateurs.*

UoSAT features two "regular" beacons, one on 145.825 MHz transmitting general data, the other relaying engineering and scientific data on 432.05 MHz. Both beacons will have 1200-, 300-, and 110-baud ASCII, and 45.5-baud Baudot capability. The two-meter beacon also can be modulated by a speech synthesizer or asynchronous interface to the spacecraft computer. The 70-cm beacon will provide a high-speed data channel intended for advanced amateur ground stations. In addition to the ASCII data sources, the 70-cm beacon can transmit information from three different computer interfaces, a magnetometer, and two radiation counters.

Receiving the two-meter beacon should be easy with a simple crossed-dipole antenna and an ordinary NBFM receiver. The AFSK signals can be demodulated by a low-cost terminal unit. Reception of the 432-MHz beacon is more involved since the signals will be modulated with bi-phase shift keying. One exciting piece of hardware that will accompany UoSAT is a CCD camera. This device will be pointed at the Earth, transmitting images composed of 256 × 256 pixels, with each image taking about 3½ minutes to transmit. The demodulator, memory, and interface circuitry needed to view these pictures can be built for about $250. The images can be transmitted on either beacon.

Propagation studies for the HF bands will be possible through the use of UoSAT's phase-referenced beacons on 7, 14, 21, and 28 MHz. Information about the Earth's magnetic field will be available from a flux-gate magnetometer. Solar disturbances can be monitored via two particle-flux (radiation) detectors. Another set of experimental beacons will be used to evaluate the use of microwave frequencies for amateur satellites. They will transmit on 2.4 and 10.47 GHz. UoSAT's lack of conventional two-way communications capability is eclipsed by the wide variety of signals that a ground station can receive. There is something here for everyone.

UoSAT is scheduled to ride on a NASA Delta 2310 launch vehicle as a secondary payload accompanying



Close-up of Phase IIIA satellite as it appeared mounted on the application technology capsule below the Firewheel satellite. (AMSAT photo by W4PUJ, taken in May, 1980, at the Kourou ESA facility.)

*Ground-originated telecommands to UoSAT excepted, of course.

DEATH OF A SATELLITE

A worldwide family of amateur satellite users watched anxiously during mid-June as AMSAT engineers, controllers, and managers tried to piece together a picture of AMSAT-OSCAR 7 while the old bird lay perilously close to the end of its productive life. Serious problems began to show up June 11 and 12 when the satellite was not fully responding to commands. The last confirmed QSO took place on orbit 30075 (June 12) with VK3ACR participating.

From that time onward, the transponders and beacons on AO-7 exhibited a worrisome silence and numerous monitoring stations were placed on alert on every possible orbit. This strategem paid off when several stations reported hearing transponder hash and other signs of recovery. The optimism was short-lived—in the days that followed, all transmissions ceased.

While at first it was feared that the malfunctions had been catastrophic and total with no symptoms at all to diagnose, now there are a few pieces of the puzzle to assemble. Jan King W3GEY, AMSAT Vice President for Engineering, stated that he felt a 5- or 10-degree Celsius thermal shock caused by the sudden exposure to deep shadow might have been enough to cause a failure in one of the weakened, aged nicad batteries. Such a failure mechanism might come about through nonuniform heating of a cell, causing, for example, the plate separators to warp and cause a short circuit.

The thermal stress hypothesis is based on the fact that OSCAR 7 experienced a solar eclipse for part of each orbit. The eclipses, which, in theory, started on June 1, were calculated to end on or about July 5. The reports of OSCAR 7's demise are tempered by its exemplary record. The 64-pound bird was launched on November 15, 1974, making it one of the longest-lived satellites in history. Its 6.6 years of service is more than double the three years originally expected. An estimated 10,000 to 15,000 amateurs utilized the satellite, making millions of QSOs.

The construction of the spacecraft was an international effort, with the Mode A transponder built by Americans, the Mode B transponder supplied by German hams, the RTTY encoder coming from Australia, and the 70-cm beacon constructed by Canadians. OSCAR 7 also included a super high frequency (SHF) beacon that was never turned on because the FCC failed to provide authorization.

The failure of AO-7 is like losing a close and valued friend. However, we can look back with pride at OSCAR 7's multitude of accomplishments.

The preceding report is based on material in the June 19 issue of the AMSAT Satellite Report.

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the Solar Mesosphere Explorer spacecraft. The satellite's orbit wil resemble the OSCAR 7 and 8 orbits. The 530-km, sun-synchronous, polar, Earth orbit will result in UoSAT circling the Earth every 95 minutes with a latitude increment of approximately 23.75° per orbit. If all goes according to plan, UoSAT will be launched in September, 1981, and, assuming success, become known as OSCAR 9.

Phase IIIB

The OSCAR 9 designator was originally going to belong to the Phase IIIA spacecraft. After its ill-fated launch attempt, the dream that accompanied this ambitious AMSAT program almost came to a halt. Not only did the complex expensive electronic hardware have to be replaced, but a new launch opportunity also was needed. Without a ride, a satellite would be next to useless! In the year that followed Black Friday, the AMSAT crew has overcome these problems. Two new spacecraft are being assembled (Phase IIIB and C) by an international team of amateurs. Phase IIIB is scheduled for a launch during the summer of 1982 aboard an Ariane rocket which will also carry ECS-1 (European Communications Satellite #1). Phase IIIC is being built for a 1983-1984 launch.

The Phase-IIIB bird, with the emphasis on "B", will resemble its predecessor but also will incorporate some significant changes. There will be the mode-B transponder, which has an uplink on 70-cm and a downlink on two meters. In addition to mode B, the new satellite will have an L-band transponder. Users will transmit to the satellite on the new 1269-MHz satellite allocation and receive on a 70-cm downlink. The use of the new 1269-MHz allocation presents some unique challenges to UHF-microwave experimenters since very little commercial equipment is available in the Western Hemisphere. (It proliferates in Europe.)

Several weeks after the spacecraft is launched from the European Space Agency's French Guiana facility, a kick-motor (a small liquid-fuel rocket) will be used to move it into a highly elliptical orbit. This orbit will allow some users to have access to the bird for approximately eight hours at a time. The "slow" apparent movement of the satellite will greatly simplify antenna tracking.

Phase IIIB promises to be the ultimate repeater, where nearly a third of the world will be in range. DX-ers will have the capability to work stations on four continents without having to worry about propagation. Through its technical challenge and communications capability, Phase IIIB will be a big part of ham radio in the 1980s.

Sky-High Dreams

The future of amateur radio's satellite program does not end with UoSAT and Phase IIIB. Plans are being made for another Phase-III bird. While the Phase-III program promises to give worldwide communications capability, it still does not fulfill the dream of providing global coverage for every ham, 24 hours a day. Enter Phase IV, in which SYNCART satellites are being planned for geosynchronous orbits. If three SYNCART packages were linked, it would be possible to talk to almost any ham on the Earth, 24 hours a day, with 100% reliability. Transforming this dream into reality will require an extraordinary amount of cooperation and innovation. Where does the future of our hobby lie? Perhaps we should look to the sky for an answer. ■

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↵See List of Advertisers on page 114

Jeff DeTray WB8BTH
73 Magazine Staff

You Can Scan with the Iscan

—memory scanning for the TR-9000

Kenwood's TR-9000 is a fine radio—no doubt about that. In fact, it has turned out to be exactly what I wanted in an all-mode 2-meter transceiver. . . with one small exception. While the 9000 has the built-in capability to perform scanning of the entire band, no provision is made for scanning the five memories.

The TR-9000's memories are selected by means of a front-panel rotary switch. However, since I like to keep tabs on several repeaters when I'm driving, I discovered that I was forever reaching down to fumble with the switch, much to the detriment of my driving. Sure enough, the minute I selected one frequency, it would go silent, and I'd again be groping for the memory switch. Enter the Iscan I-90, a memory-scan modification for the TR-9000.

Installation

Adding the I-90 to the 9000 is a relatively simple procedure. The I-90 package consists of an assembled 2" × 2" PC board containing four ICs, 12 pieces of very small-gauge insulated wire already cut to the proper lengths, and three pages of instructions, one sheet of which holds several helpful illustrations.

Installation of the I-90 involves attaching the 12 wires to various points inside the TR-9000 and to the I-90 PC board. For the most part, the wires are simply tack soldered to convenient pads inside the 9000, although one existing wire must be rerouted. It is a very clean modification and from start to finish, the whole procedure takes less than an hour. The instructions proved to be complete and understandable. A steady hand and a fine-tip soldering pencil are necessary due to the close quarters inside the 9000. The I-90 fits into the bottom of the TR-9000 cabinet, and absolutely no external modifications to the rig are required.

Operation

Using the I-90 is simple. With the Memory Recall button on the TR-9000 depressed, a touch of the 9000's Scan button sends the rig scanning through the five memorized frequencies. Scanning stops whenever a busy channel is encountered and resumes again when the carrier drops. A quick depression of the microphone's push-to-talk button forces the scan to continue past a busy channel. To return the radio to normal operation, it is necessary only to touch the transceiver's Hold button.

As you can see from the above description, the I-90 is a very clean mod. It makes use of existing controls and does not impair normal operation in any way. The many other scanning features of the TR-9000 are unaffected.

Summary

Although it was a minor annoyance in an otherwise fine rig, I did feel the lack of a memory scan in the stock TR-9000. When the I-90 came along, I was a bit hesitant to grab my soldering pencil and attack a nearly new radio. The results, however, have been well worth the small investment of time and money. In fact, the Iscan I-90 is so simple and does its job so well that one wonders why Kenwood did not include a similar circuit as standard equipment on the TR-9000. At $39.95, it's a bargain. The I-90 is available from *Iscan Engineering, Route 1, Box 90A, Antioch IL 60002.* Reader Service number 478.■

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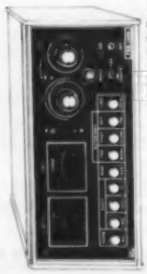

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SOCIAL EVENTS

from page 65

cial building at 9:00 am. Activities include forums, amateur and computer product displays, a flea market, ladies' programs, and children's activities. Full camping facilities are available. Talk-in on 146.16/.76. For more information, contact Charles W. Kuhn WD9EGW, 7005 N. Tobi Lane, Peoria IL 61614.

NEWTOWN CT
SEP 20

The Candlewood Amateur Radio Association's flea market and auction will be held on Sunday, September 20, at the Essex House, Rte. 6 in Newtown CT, Exit 8 off I-84, from 10:00 am to 4:00 pm. Admission is $1.00; tables are $6.00. Activities include door prizes, a raffle, dealers, and a magic show for the kids. Talk-in on 147.72/.12. For more information, contact George WB2THN at (914)-533-2758 or Ken KA1GDS at (203)-744-6953.

ROSS OH
SEP 20

The Greater Cincinnati Amateur Radio Association, Inc., will hold its annual Cincinnati Hamfest on Sunday, September 20, 1981, at Stricker's Grove on Ohio State Rte. 128, one mile west of Ross (Venice) OH. There will be exhibits, 10 major prizes, food, and refreshments available. Activities include a flea market with radio-related products only, a transmitter hunt, entertainment, and an air show. Admission is $4.00. For further information, contact Lillian B. Abbott K8CKI, 1424 Main Street, Cincinnati OH 45210.

MT. CLEMENS MI
SEP 20

The L'Anse Creuse Amateur Radio Club will hold its 9th annual Swap and Shop on Sunday, September 20, 1981, from 9:00 am to 3:00 pm at the L'Anse Creuse High School, Mt. Clemens MI. Take I-94 east-bound to the Metropolitan Parkway exit, then the Metropolitan Parkway to Crocker, go left on Crocker to Reimold and then right on Reimold to the last school, L'Anse Creuse High School. Admission is $2.00 at the door or $1.00 in advance. There will be FCC representatives and a test equipment table. There will be plenty of food and parking, plus hourly prize drawings. Prizes include a first prize of $250, a second prize of $100, and third prize of $50. Talk-in on 147.69/.09 and 146.52. For more information, send an SASE to Mike Corcoran N8CEN, 650 Chippewa, Mt. Clemens MI 48043.

AUGUSTA GA
SEP 20

The Augusta Amateur Radio Club will hold its annual hamfest on Sunday, September 20, at the Julian Smith Casino in Augusta GA. Tickets are $1.00 each; tailgaters, $3.00. Open at 9:00 am, everything is indoors except the flea market. There will be door prizes, a grand prize drawing at 3:00 pm, bingo, and refreshments. Talk-in on 146.34/.94. For more information, contact Diane Miller WB4YHT at (404)-860-3700.

FLINT MI
SEP 20

The Genesee County Radio Club, along with the Bay Area Amateur Radio Club, the Lapeer County Amateur Radio and Repeater Club, the Saginaw Valley Amateur Radio Association, and the Shiawassee Amateur Radio Association, will hold their fifth annual Five-County Swap-N-Shop on Sunday, September 20, 1981, from 7:30 am to 4:00 pm at the Bentley High School, 1150 Belsay Road (just north of I-69), Flint MI. Tickets are $2 per person in advance and $3 at the door. Children under 12 will be admitted free. There will be a food concession, free parking, and prizes (including a main prize of a Bearcat 210XL scanner). Talk-in on 146.52. Rent for an 8-foot table is $8; for reservatons, write Ed King K8OT, 10885 Dehmel, Birch Run MI 48415, or phone (517)-624-9094. For advance tickets, contact Ed King at the above address, or Don Williams KG8X, 5114 Knapp Drive, Flint MI 48506.

ARGOS IN
SEP 20

The Marshall County Amateur Radio Club will hold its 6th annual hamfest and electronics flea market on Sunday, September 20, 1981, at the 4-H Fairgrounds in Argos IN. Activities will include door prizes, refreshments, and a grand prize of $200. For more information, contact Paul R. DeVos WB9VFJ, 109 Maple Avenue, North Liberty IN 46554; (219)-656-4631.

ELMIRA NY
SEP 26

The Elmira Amateur Radio Association will hold the sixth annual Elmira International Hamfest on Saturday, September 26, 1981, at the Chemung County Fairgrounds. Gates will open at 8:00 am. Tickets are $2.00 in advance and $3.00 at the gate. Features will include a free flea market, tech talks, and dealer displays. Food will be available and door prizes will be awarded. The grand prize will be three items: an Icom IC-255A, an Icom IC-2AT, and an Avanti mobile antenna. A shuttle service from the Chemung County Airport will be provided for fly-ins who bring an HT. Talk-in on 147.96/.36, 146.10/.70, and 146.52/.52. For more information and/or tickets, contact John Breese WA2FJM, 340 West Avenue, Horseheads NY 14845.

LOUISVILLE KY
SEP 26-27

The eleventh annual Greater Louisville Hamfest and the 1981 Great Lakes Division Convention will be held on September 26-27, 1981, at the East Hall of the Kentucky Fair and Exposition Center in Louisville KY. There will be a large indoor exhibitors' area and flea market, completely air-conditioned. For more information, write The Greater Louisville Hamfest, PO Box 34444, Louisville KY 40232, or phone (502)-634-0619.

VIRGINIA BEACH VA
SEP 26-27

The 6th annual Tidewater Hamfest-Computer Show and ARRL Roanoke Division Convention will be held in the Virginia Beach Pavilion on September 26-27, 1981. Featured will be ARRL, traffic, and DX forums and XYL free bingo. FCC license exams will be given to those sending a form 610 request in advance. Free transportation to the oceanfront will be provided for the Neptune Festival. Admission is $3.50. There will be an advance ticket drawing for a handheld FM transceiver. Flea market tables are $5.00 for one day or $7.00 for both days. For tickets and information, write TRC, PO Box 7101, Portsmouth VA 23707, or phone (804)-587-1695.

ANNISTON AL
SEP 26-27

The Calhoun County Amateur Radio Association will hold its second annual hamfest on September 26-27, 1981, from 9:00 am to 5:00 pm on Saturday and from 9:00 am to 3:00 pm on Sunday, in the Municipal Auditorium, 1128 Gurnee Avenue, Anniston AL. Admission and parking will be free. Donations are $1.00 for one or $5.00 for 6. Tables are $3.00 for one day or $5.00 for two days. Free overnight parking for self-contained RVs will be available. Features will include a large air-conditioned exhibit area, free bingo on both days, hourly door prizes, MARS and ARRL forums, FCC examinations, and a final drawing on Sunday to award a Ten-Tec Delta Model 580, plus many other prizes. Talk-in on .69/.09; rag chew on .10/.70. Reduced rates will be available at the Anniston Downtowner Motor Inn. There will be a hospitality room at the Downtowner on Saturday evening. Contact Dale Boothe KA4LRL, c/o CCARA, PO Box 1624, Anniston AL 36202 for additional information.

CEDAR RAPIDS OH
SEP 27

The Cedar Valley Amateur Radio Club will hold its 7th annual CVARC Hamfest on Sunday, September 27, 1981, starting at 7:00 am at the Hawkeye Downs exhibition building in Cedar Rapids OH. Included will be an overnight camping area, picnic facilities, food, prizes, ARRL representatives, and movies. Talk-in on 146.16/.76, .52, and 223.34/.94. For advance tickets and reservations, write CVARC Hamfest, PO Box 994, Cedar Rapids IA 52406.

BEREA OH
SEP 27

The Cleveland Hamfest Association will present the 7th annu-

MFJ-1200 GENERAL PURPOSE

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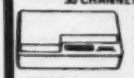

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al Cleveland Hamfest on Sunday, September 27th, 1981, from 0800 to 1500 hours, at the Cuyahoga County Fairgrounds in Berea OH. Activities will include indoor exhibits, forums, a ladies' program, and an outdoor flea market with separate parking. Food services will include both breakfast and lunch. There will be three main prizes and a mobile check-in prize. Talk-in on 146.52 (W8QV). Advance tickets are $2.50 prior to August 31; $3.00 at the door. Contact the Cleveland Hamfest Association, PO Box 27211, Cleveland OH 44127.

BOULDER CO
SEP 27

The Boulder Amateur Radio Club will hold Barcfest/81 on Sunday, September 27, 1981, beginning at 9:00 am at the Boulder National Guard Armory, 4750 North Broadway, Boulder CO. An admission donation of $2.00 per family includes swap space and door prize drawing. There will also be a snack bar and an auction. Talk-in on 146.10/.70 and 146.52. For further information, contact Mark Call N0MC, 4297 Redwood Court, Boulder CO 80301, or phone (303)-442-2616.

ISLIP LI NY
SEP 27

The Long Island Mobile Amateur Radio Club (LIMARC) will sponsor the ARRL Hamfair '81, part II, on Sunday, September 27, 1981, at Islip Speedway, Islip NY. Food and refreshments are available at concession stands and many awards will be presented all day. General admission is $2.00; exhibitors' space is $5.00. Ladies and children will be admitted free. For more info, contact Sid Wolin K2LJH at (516)-379-2861 (nights) or Hank Wener WB2ALW at (516)-484-4322.

GAINESVILLE GA
SEP 27

The 8th annual Lanierland ARC Hamfest will be held on September 27, 1981, beginning at 9:00 am in the Holiday Hall at the Holiday Inn, Gainesville GA. Doors will open at 8:00 am for dealer setups, and free tables and an inside display area will be provided. A large parking lot will be available for the flea market, and all activities and facilities will be free to all. A boat anchor auction and prize drawings will be featured. Prize tickets are $1.00 each or 6 for $5.00. Food will be available next door. Talk-in on 146.07/.67. For more information and free dealer space reservations, contact Paul Watkins W4FDK, Rte. 11, Box 536, Gainesville GA 30501, or phone (404)-536-8280.

GRASS VALLEY CA
SEP 27

The Golden Empire Flying Club and Radio Systems Technology are pleased to announce the annual fly-in and avionics swap meet to be held at the Nevada County (CA) Airpark on Sunday, September 27, 1981. The pilot of any antique or home-built aircraft will receive a free "miner's lunch" and a beverage of the pilot's choice. Pastries, bratwurst, and hot dogs will be available also. The swap meet will be free. Table space is limited and it is first-come, first-served. This is the only swap meet in the country to feature the trading of used avionics products. Pilots are reminded that Nevada County Airport is considered a mountain strip, and are advised to check density altitude. For more information, contact Golden Empire Flying Club, PO Box 375, Grass Valley CA 95945.

ADRIAN MI
SEP 27

The Adrian Amateur Radio Club will hold its hamfest on September 27, 1981, at the Lenawee County Fairgrounds, Adrian MI, from 8:00 am to 3:00 pm. There will be prizes, games, and programs. Limited tables available and inside space available for your table. Tickets are $1.50 in advance; $2.00 at the door. Talk-in on 146.31/.91 and .52. For tickets, tables, and information, contact the Adrian Amateur Radio Club, Inc., PO Box 26, Adrian MI 49221. Tables reserved by check no later than September 20.

NEW LONDON NH
SEP 27

The 5th annual Connecticut Valley FM Association hamfest/flea market will be held on Sunday, September 27, 1981, from 9:00 am to 5:00 pm at the King Ridge Ski Area, New London NH. Adult admission will be $1.00 and flea market setup will be $5.00. Children under 16 will be admitted free. The food concession will be by King Ridge.

NEW BERLIN IL
SEP 29

The Sangamon Valley Radio Club of Springfield, IL, will hold its sixth annual hamfest on Sunday, September 29, 1981, at the Sangamon County Fairgrounds, New Berlin, IL twelve miles west of Springfield on Rte. 36. There will be an indoor display and a covered pavilion for the flea market. Exhibits, kids' activities, and food will be available, along with overnight camping. First prize is an Icom synthesized HT. Tickets are $2.00 in advance; $2.50 at the gate. For more information, contact SVRC, c/o Red Cross Building, 1025 S. Sixth St., Springfield IL 62703.

WAUKESHA WI
OCT 11

The KMRA Hamfest '81 will be held on Sunday, October 11, at the Waukesha Exposition Center, Hwy. FT, Waukesha WI. Tickets are $2.00 in advance; $3.00 at the gate. Talk-in on .52. For more info, or advance tickets, write KMRA Hamfest '81, 315 Morey Street, Waukesha WI 53186.

HAM HELP

I'm looking for a Swan 500 transceiver operation manual and schematic diagram. Thank you very much.

Manuel Avendano XE1ABR
Sur 141 #2316
Mexico 8, D.F.

I have been doing some serious listening at low frequencies—50 to 500 kHz—where noise is the problem.

I would like to correspond with anyone who has good technical information and/or experience with shielded antennas, loops or otherwise.

James L. Weiss W9ZMV
Box 840
Hillside IL 60162

I need a schematic for an American Bosch Radio Receiver, model 5A, manufactured by United American Bosch Corporation, Springfield MA. Thanks.

Jeff DeTray WB8BTH
73 Magazine
Peterborough NH 03458

I need some assistance with a problem I've been having. I have been trying to build a large Tesla coil for a while now. The project has been worked on when I have spare time (which is hard to come by these days, as you well know). My problem is that I can't get the thing to work! I'm sure the problem is resonating the coil. I can't seem to come up with the right value capacitor. I have a few books on Tesla, but none of them gives details on figuring out circuit values. Could anyone suggest any books or articles where I might find detailed information on building the coil?

Bob Billson WA2TXY
837 Summit Ave.
Westfield NJ 07090

I need a schematic and/or manual for a Dumont 401B oscilloscope. I will pay for copying or will copy and return, all postage paid.

Arthur Durea N4CJW
102 Indian Lane
Oak Ridge TN 37830
(602)-483-0784

Is anyone using the Heath H-89 on CW? Where can I get CW software?

D. R. Kight WA5RER
PO Box 1651
Abilene TX 79604

I need a manual and/or schematic diagram for a Globe Electronics Globe Scout Deluxe. I will pay for postage and copying costs.

Brian T. Sullivan
4300 Ivanhoe Place
Alexandria VA 22304

I need a schematic or operating instructions for pre-zip-code Simpson Model 372 ohmmeter. I will reimburse expenses.

Mickey McDaniel W6FGE
940 Temple St.
San Diego CA 92106

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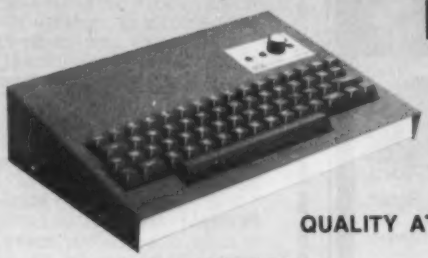

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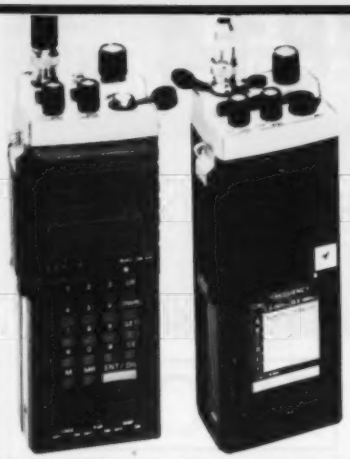

YAESU FT-207R (left) 2m FM Hand-held Transceiver. Microprocessor controlled, 800 channels - keyboard entry 144 to 148 MHz. LED display, up/down manual or autoscan for busy/clear channel, priority channel with search back, keyboard lock, memory back-up & display on/off switch. ± 600 kHz offsets or any odd splits. 2½w (hi), 200 mw (lo) output. With Nicad pack, wall charger, flex ant., earphone & strap. 7⅛"h × 2⅜"w × 2¼"d, 1¼ lbs.

Regular Price $339 - ***Sale $269.95***

YAESU FT-404R (right) 450 MHz Hand-held FM Transceiver. Six crystal controlled channels within a 3 MHz (tx) or 5 MHz (rx) spread, 430 to 450 MHz. Output: 2½w (hi), 200 mw (lo). With NiCad battery pack, wall charger, flexible antenna, case, strap, earphone & crystals for one channel, 446.0 mHz simplex. 7⅛"h × 2⅜"w × 2¼"d, 1 lb.

Regular $299 - ***Closeout $239.95***

FT-404R/TTP same features as FT-404R above, plus a factory installed 16-button Touchtone pad.

Regular $325 - ***Closeout $269.95***

Accessories for FT-207R & FT-404R:

NC-1A	15-hr drop-in charger	Sale $44.95
NC-3A	15/4 hr drop-in chgr/AC adaptor	Sale 79.95
FBA-1	Battery sleeve for NC-1A/3A	8.00
FNB-1	Extra NiCad battery pack	23.00
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PA-2	Mobile DC-DC adaptor & charger	39.00
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FTS-32E	32 tone CTCSS encoder	40.00
FTS-32ED	32 tone CTCSS enc/dec	75.00
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TA-2	19" telescoping whip antenna for 207R	9.40
MMB-10	Mobile bracket	15.00
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Older YAESU FT-101ZD (Mk II) 9-band, 180w, HF Transceiver with AM. A mid-priced unit loaded with features. Both digital and analog readout, variable IF bandwidth, noise blanker, RF speech processor, built-in 117 VAC & 13.5 VDC (with optional DC-DC converter). Uses FT-902DM accessories. 13½"w × 7"h × 13"d, 33 lbs.

Regular $889 - ***Closeout $749.95***

YAESU FV-101Z External VFO for the FT-101Z/ZD, FT-901/902 - series transceivers. Enjoy the convenience and versatility of operating " separates".

Precision tuning mechanism with analog dials that read to 1 kHz. Clarifiers with ± 2.5 kHz offset for TX, RX, or Transceive frequencies, VFO Shift feature allows ± 8 kHz shift from main dial frequency to check for activity. Six fixed frequency positions - crystals (optional) can be varied with ± 200 Hz fine tuning control. VFO status is continually shown by LED indicators. Supplied with interconnecting cable. 6"h × 8½"w × 13"d, 10 lbs.

Regular $175 - ***Closeout $129.95***

YAESU FT-707 8-band HF Transceiver for 80 to 10m, including WARC bands. Rated 240w DC SSB/CW, 80w AM. LED digital or analog readout & Led level meter. Scan mic., VOX, semi-break-in, calibrator, sel. AGC, noise blanker, clarifier, variable I.F. bandwidth, crystal control provision. 13.5 VDC/15A. 3¾"h × 9½"w × 9¾"d, 15 lbs.

Regular Price $810 - ***Sale $699.95***

Accessories for FT-707

FP-707	Power Supply	Sale $145.95
FV-707M	Digital VFO w/ 12 memories	Sale 249.95
FC-707	8-band antenna tuner	Sale 119.95
FRB-707	Relay box	39.00
MMB-2	Mobile mounting bracket	20.00
MR-7	Mounting rack	20.00
XF8.9HC	600 Hz Cw filter	45.00
XF8.9HCN	350 Hz CW filter	50.00

YAESU FT-720RVH 25 watt 2m FM Transceiver. Microprocessor controlled, 144 to 147.99 MHz. Priority channel, ± 600 KHz offsets, four memory channels plus a "receive memory" for odd splits. Up/down scanning of dial & memory channels controlled from microphone. 1750/1800 Hz tones, LED display and indicators. Combination control head and 144 MHz/25w RF deck which detaches for remoting or to use optional 720RU 440 MHz/10w RF deck. Optional switching box (S-72) for using both decks for two band operation. With microphone, wire stand, mobile mount, DC cord w/cig plug. 13.8 VDC/6½ A. 6"w × 2"h × 10"d, 5½ lbs.

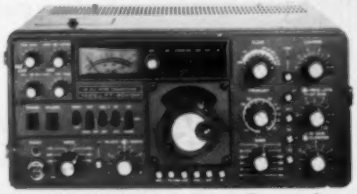
Regular $429 - ***Closeout $349.95***

FT-720RU 10 watt 440 MHz FM Transceiver. As 720RVH above, but for 440 to 449.975 Mhz. Combination control head with 720RU RF deck. Optional 720 RVH deck for 144 MHz/25w and optional S-72 for two bands. 13.5 VDC/4A.

Regular $449 - ***Closeout $359.95***

Accessories for FT-720R:

720RVH	144 MHz/25 watt RF deck	Sale $205.95
720RU	440 MHz/10 watt RF deck	Sale 225.95
S-72	RVH/RU switching box	Sale 79.95
E-72S	6½' cable for remoting RF deck	35.00
E-72L	13' cable for remoting RF deck	40.00



FT-902DM 9-band digital Transceiver

Regular Price $1535 - ***Sale $1299***

Accessories for FT-902DM

SP-901	Speaker	$35.00
SP-901P	Speaker/patch	Sale 69.95
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FV-901DM	Remote VFO w/memory	Sale 372.95
FC-902	9-band ant. tuner, 500w PEP	Sale 179.95
FTV-901R	Transverter w/2m	Sale 349.95
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	440 MHz adaptor	Sale 229.95
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Frequency Coverage	50-150MHz
Power Measuring Mode	AVE & PEP 2 modes
RF Power Range	0-200, 1,000, 2,000W, 3 ranges ± 10%
Power Source	AC 117V, 60 Hz
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Net Weight	2.2 lbs. (1 kg)

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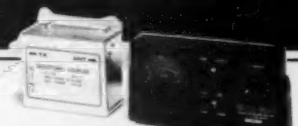
Excellent position through-line SWR/Watt meter specially designed to have flat frequency response.

Specifications:

Frequency Coverage	50-150MHz
RF Power Range	0-200W, 2 ranges ± 10% accuracy
Dimensions	8"[W] x 4"[H] x 5½"[D]
Net Weight	2.2 lbs. (1 kg)



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The PM-5H is especially designed for mobile installation of which directional coupler unit and meter unit are separated.

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RF Power Range	0-20, 200W ± 10% accuracy
Power Requirements	12V DC (for meter illumination)
Accessory Included	6ft. long connector cable and velcro for mobile mounting.
Dimensions:	5⅛"[W] x 2¼"[H] x 1½"[D]: Meter 3⅛"[W] x 2½"[H] x 1¼"[D]: Coupler
Net Weight	0.45 lbs. (200 grams): Meter 0.67 lbs. (300 grams): Coupler

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Designed to cover VHF band. Illuminated meter is convenient to the use in mobile operation. A complete set to be in display carton.

Specifications:

Frequency Coverage	50-150MHz
RF Power Range	0-20, 200W ± 10% accuracy
Power Requirements	12V DC (for meter illumination)
Accessory Included	6ft. long connector cable and velcro for mobile mounting
Dimensions	5⅛"[W] x 2¼"[H] x 1½"[D]: Meter 3⅛"[W] x 2½"[H] x 1¼"[D]: Coupler
Net Weight	0.45 lbs. (200 grams): Meter 0.67 lbs. (300 grams): Coupler

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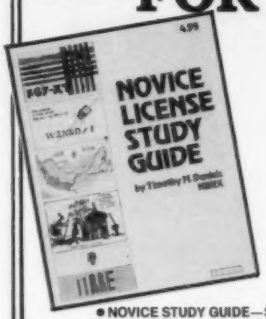

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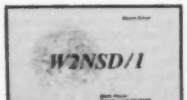

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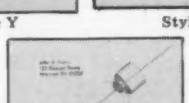

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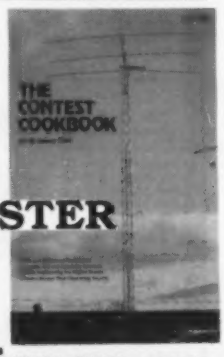

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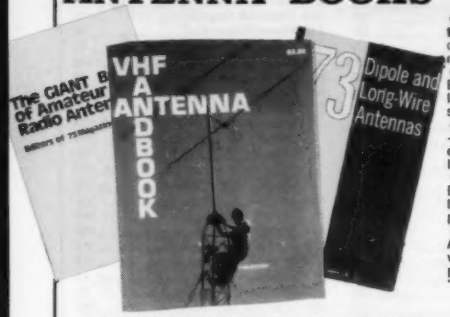

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2. ☐ 18-22
3. ☐ 23-30
4. ☐ 31-40
5. ☐ 41-60
6. ☐ Over 60

II. Are you living on a fixed, or retirement, income?
A. ☐ Yes
B. ☐ No

III. How long have you been a ham?
1. ☐ Less than one year
2. ☐ 1-5 years
3. ☐ 6-10 years
4. ☐ 11-25 years
5. ☐ Over 25 years

IV. What class license do you hold?
A. ☐ Novice
B. ☐ Technician
C. ☐ General
D. ☐ Advanced
E. ☐ Amateur Extra
F. ☐ Not licensed

V. Are you an ARRL member?
1. ☐ Yes
2. ☐ No

VI. If yes to question 5, please indicate membership.
A. ☐ Regular
B. ☐ Life

VII. How much time do you spend hamming?
1. ☐ Less than 10 hours per week
2. ☐ More than 10 hours per week

VIII. Is Amateur Radio your only hobby?
A. ☐ Yes
B. ☐ No

IX. Please list your other major interests.
1. ☐ Computers
2. ☐ Flying
3. ☐ Photography
4. ☐ Outdoor sports

X. Do you belong to an Amateur Radio Club?
A. ☐ Yes
B. ☐ No

XI. If yes to above, does your club have a Novice or newcomers class?
1. ☐ Yes
2. ☐ No

XII. Do you plan to build any equipment during the next year?
A. ☐ Yes
B. ☐ No

XIII. Did you build any equipment during the past year?
1. ☐ Yes
2. ☐ No

XIV. Do you own a microcomputer?
A. ☐ Yes
B. ☐ No

XV. Do you plan to purchase a microcomputer during the next year?
1. ☐ Yes
2. ☐ No

XVI. If you are not a subscriber please circle 500.

XVI. In general, I enjoy 73's columns (Looking West, RTTY Loop, etc.).
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XVII. If your answer to the previous question was yes, please rank the columns by order of preference (1 = favorite, 9 = least favorite).
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WHAT WILL YOUR NEW RIG BE LIKE?

Read 73 and Find Out

The magic of digital electronics is coming to ham gear . . . and you'll be able to read about these developments in *73*. There probably will be more changes in ham equipment in the next few years than ever before in history. You'll see these changes coming in *73*, where you'll read about the experiments and pioneering. *73* has more articles than any other ham magazine . . . often more than all the others combined.

When sideband got started, it was moved along by the many pioneering articles in *73*. In the 60s it was solid state, with several times as many articles on the subject than in all the other magazines combined. When repeaters and FM got going about ten years ago there were over five times as many articles on the subject published in *73* as in all other ham magazines combined . . . and you can see what changes that brought to hamming. Now we're looking at exciting developments such as narrow band sideband for repeaters . . . which might give us six times as many repeaters in our present bands. We're looking at automatic identification systems which may make it possible for us to read out the call letters of any station tuned in . . . and even the development of self-tuning receivers.

Will stereo double sideband techniques make it possible to have up to 30 times as many stations within a given HF band as is now possible? Hams will be experimenting and reporting on these developments in *73*. *73* is an encyclopedia of hamming . . . present and future . . . and just a bit of the past, too.

Without the endless fillers on station activities and club news, *73* is able to publish far more information . . . valuable information . . . on hamming and ham equipment.

You may or may not be a pioneer, but you certainly will want to keep up with what is happening and what the new rigs are going to be like. And, frankly, your support of *73* is needed to keep this type of information coming.

Yes, bill me for 1 year of 73 Magazine at $25.00

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CONTESTS

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WAS SSTV CONTEST

Starts: 1300 GMT September 5
Ends: 0100 GMT September 8

This is a simple A5 SSTV "Worked All States" contest designed to give the operator a maximum of 60 hours of available time in which the purpose is to work as many of the states as possible via slow-scan television. The time limitations were chosen for operating convenience and propagation fairness. Don't forget Alaska and Hawaii if available.

As in the January contest sponsored by *Amateur Television Magazine*, the contest is designed for quality rather than quantity. The extended operating time period and encouragement of unpopular SSTV band segments ensures minimum QRM between SSTV operators and experimentation in operation on all amateur bands.

All contacts must incorporate the video/signal report in video as well as the call letters of the stations worked. A bonus factor of 10 may be added to those SSTV contacts on non-popular bands as noted with an asterisk in the list of frequencies. Additional contacts within the same state count only as bonus points. Other than suggested frequencies may be used as long as the frequency used is legally authorized for SSTV operation. Log entries (or submitted copies) must include the signature of the operator and be mailed to Mike Stone WB0QCD, *A5 Magazine* Contest Manager, PO Box H, Lowden IA 52255 by midnight, September 10th. Include an SASE for logs that are to be returned. Results will be published in the Nov/Dec issue of *A5 Magazine*.

The winning entry with the most states worked and bonus points will receive a one-year subscription to *A5 Magazine* and a contest certificate. Second and third place winners will receive certificates. Stations completing all 50 states will have their picture published in *A5 Magazine* with a writeup.

FREQUENCIES:

3845-3855*, 7220-7230*, 14230-14240, 21340-21350*, 28680-28690, 50.20-50.21*, 144.23-144.24 (SSB)*, 146.43 (FM)*.

NEW MEXICO QSO PARTY

Starts: 0000 GMT September 12
Ends: 2400 GMT September 13

Sponsored by the Albuquerque DX Association. Crossband and repeater contacts may not be counted for scoring. Each station may be worked once on each band and each mode. NM stations operating mobile may be worked again in each county.

EXCHANGE:

RS(T), QSO number, and state, province, DX country, or NM county.

FREQUENCIES:

CW—63 kHz from the low end of each band; SSB—3900, 7265, 14285, 21365, 28650; Novice—3705, 7105, 21105, 28105. Stations outside NM please refrain from calling CQ NM near these frequencies!

SCORING:

Each QSO counts one point. NM stations multiply total QSO points by the total number of states, provinces, and DX countries worked on each band, each mode. All others, multiply total QSO points by the total number of NM counties worked each band, each mode.

AWARDS:

Plaques will be presented to the top scorers from NM and outside NM. Certificates awarded top scorers from each state, province, and DX country. Special award presented to any station working all 33 NM counties during the QSO party!

ENTRIES:

Stations reporting 100 or more QSOs please include dupe sheets. Entries must be postmarked no later than October 15th and addressed to: Albuquerque DX Association, PO Box 997, Corrales NM 87048. Include an SASE for complete results.

WASHINGTON STATE QSO PARTY

Contest Periods:
0100 GMT to
0700 GMT September 12
1300 GMT September 12 to
0700 GMT September 13
1300 GMT September 13 to
0100 GMT September 14

The sixteenth annual contest sponsored by the Boeing Employee's Amateur Radio Society (BEARS) is divided into three operating periods as shown. All amateurs are invited to participate. Use all bands and modes, but no CW QSOs are allowed in the phone bands. Stations may be worked once on each band and mode for contact points and more than once each band/mode if they are additional multipliers.

EXCHANGE:

QSO number, RS(T), and state, province, country, or Washington county.

FREQUENCIES:

Phone—1815, 3925, 7260, 14280, 21380, 28580; CW—1805, 3560, 7060, 14060, 21060, 28160; Novice—3725, 7125, 21150, 28160.

SCORING:

Washington stations score 2 points for each phone contact and 3 points for each CW contact, including contacts with other Washington stations. Multiply QSO points by the total number of different states, Canadian provinces, and other foreign countries worked. All others score 2 points for each phone contact and 3 points for each CW contact with a Washington station. Multiply QSO points by the total number of different Washington counties worked (39 maximum). There will be an extra multiplier of one for each group of 8 contacts with the same Washington county for all non-Washington stations.

AWARDS:

Certificates will be awarded to the highest-scoring station (both single and multi-operator) in each state, Canadian province, foreign country, and Washington county. Additional

CALENDAR

Sep 5-7	**WAS SSTV Contest**
Sep 12-13	**European DX Contest—Phone**
Sep 12-13	**G-QRP-Club CW Activity Weekend**
Sep 12-13	**New Mexico QSO Party**
Sep 12-14	**Washington State QSO Party**
Sep 19-20	**Maryland-District of Columbia QSO Party**
Sep 19-20	**College Scrimmage**
Sep 19-20	**Can-Am Contest—Phone**
Sep 26	**DARC Corona—10-Meter RTTY**
Sep 26-27	**Maine QSO Party**
Sep 26-27	**Can-Am Contest—CW**
Oct 3-4	**California QSO Party**
Oct 17-18	**Minnesota QSO Party**
Oct 17-18	**Scout Jamboree On The Air**
Oct 17-18	**Pennsylvania QSO Party**
Oct 24-25	**CQ World-Wide DX Contest—Phone**
Nov 7-8	**Antigua & Barbuda Independence QSL Party**
Nov 8	**DARC Corona—10-Meter RTTY**
Nov 8	**OK DX Contest**
Nov 14-15	**European DX Contest—RTTY**
Nov 28-29	**CQ World-Wide DX Contest—CW**
Dec 26-31	**G-QRP-Club Winter Sports**
Jan 16-17	***73*'s International 160-Meter Phone Contest**
Jan 16-17	**International SSTV Contest**

certificates may be issued at the discretion of the Contest Committee. Worked Five BEARS Awards are also available to anyone working 5 club members before, during, or after the QSO party (unless previously issued). All QSO Party entries will be screened by the Contest Committee for possible Worked Five BEARS Awards. Worked Three BEAR Cubs Awards are also available for working 3 Novice members.

ENTRIES:

Logs must show dates/times in GMT, stations worked, exchanges sent and received, bands and modes used, and scores claimed. Include a dupe sheet for entries with more than 100 QSOs. Each entry must include a signed statement that the decision of the Contest Committee will be accepted as final. No logs can be returned. Results of the QSO party will be mailed to all entrants and an SASE is NOT required. Log sheets and summary sheets must be postmarked no later than October 15th and be sent to: Boeing Employees' Amateur Radio Society, c/o Contest Committee, Willis D. Propst K7RS, 18415 38th Avenue South, Seattle WA 98188.

QSL OF THE MONTH

This month's winner was submitted by Dick Mobley AL7B of Anchorage AK.

If you would like to enter the contest, put your QSL *in an envelope* and mail it along with your choice of a book from *73*'s Radio Bookshop to *73 Magazine*, Pine Street, Peterborough NH 03458. Attention: QSL of the Month. Entries which do not use an envelope (the Postal Service does *occasionally* damage cards) and do not specify book choice will not be considered. Sorry.

EUROPEAN DX CONTEST—PHONE

Starts: 0000 GMT September 12
Ends: 2400 GMT September 13

Sponsored by the Deutscher Amateur Radio Club (DARC). Only 36 hours of operations out of the 48-hour period are permitted for single-operator stations. The 12 hours of non-operation may be taken in one period, but not in more than three periods, at any time during the contest. Operating classes include: single-operator allband and multi-operator single transmitter. Multi-operator, single-transmitter stations are allowed to change band only one time within a 15-minute period, except for making a new multiplier. Use all amateur bands from 3.5 through 28 MHz. A contest QSO can be established only between a non-European and a European station. Each station can be worked only once per band.

EXCHANGE:

Exchange the usual five-digit number consisting of RS and progressive QSO numbers starting with 001.

SCORING:

Each QSO counts 1 point. Each QTC (given or received) counts 1 point. The multiplier for non-European stations is determined by the number of European countries worked on each band. Europeans will use the last ARRL countries list. In addition, each call area in the following countries will be considered a multiplier: JA, PY, VE, VO, VK, W/K, ZL, ZS, UA9/UA0. The multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14 through 28 MHz by 2. The final score is the total QSO points plus QTC points multiplied by the sum total multipliers.

QTC TRAFFIC:

Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to a European station. It can be sent only from a non-European station to a European station. The general idea is that after a number of European stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported, i.e., 1300/DA1AA/134. This means that at 1300 GMT you worked DA1AA and received number 134. A QSO can be reported only once and not back to the originating station. Only a maximum of 10 QTCs to a station is permitted. You may work the same station several times to complete this quota but only the original contact has QSO point value. Keep a uniform list of QTCs sent. QTC 3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are reported. Europeans may keep the list of the received QTCs on a separate sheet if they clearly indicate the station who sent the QTCs.

AWARDS:

Certificates to the highest scorer in each classification in each country, reasonable score provided. Continental leaders will be honored with plaques. Certificates also will be given stations with at least half the score of the continental leader or with at least 250,000 points. The minimum requirements for a certificate or a trophy are 100 QSOs or 10,000 points.

ENTRIES:

Violation of the rules, unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. The decision of the Contest Committee is final. It is suggested to use the log sheets of the DARC or equivalent. Send a large SASE to get the wanted number of logs and summary sheets (40 QSOs or QTCs per sheet). SWLs apply the rules accordingly. Entries should be sent no later than October 15th, and North American residents may send their applications and logs to: Hartwin E. Weiss W3OG, PO Box 440, Halifax PA 17032 USA.

EUROPEAN COUNTRY LIST:

C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HB0, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OH0, OJ0, OK, ON, OY, OZ, PA, SM, S, SV, SV Crete, SV Rhodes, SV Athos, TA1, UA1,3,4, 6, UA2 UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, AB2, 3A, 4U1, 9H1.

NEWSLETTER CONTEST WINNER

This month's winner of the *73 Magazine* Club Newsletter Contest is the *Birmingham* (Alabama) *Amateur Radio Club Newsletter*. Not only does this publication have a very attractive layout, complete with photographs, it also offers some darned good technical information.

We found an article describing a simple RTTY demodulator and a "Technical Corner" where real-to-life problems are tackled. Your newsletter does not need to limit itself to ham-radio subjects. The BARC technical data included mention of a troublesome remote controller for a TV. Even if the readers cannot use such information immediately, they'll be able to store it away for future reference. A bit farther afield, *Zero Bias*, the Aroostook (Maine) Amateur Radio Association newsletter, published details on how to grow strawberries in a barrel.

Technical articles don't *need* to be long, involved technical treatises with professional illustrations. A few paragraphs of text accompanied by some simple drawings is all you need for a first attempt. What kinds of things can you write about? We liked the external microphone for the IC-2A described in the *Metropolitan Amateur Radio Club* (Tucson, Arizona) *Bulletin*, and the two-meter pocket antenna featured on the back cover of the *Parking Ticket*, a Plano (Texas) Radio Klub publication.

The pages of a club newsletter are an ideal place to introduce and perfect projects before submitting to magazines such as *73*. Don't let your club's editor send out a newsletter that has too much white space; contribute ideas and projects so that everyone can enjoy them.

Is your club sending its newsletter to *73*? Be a nuisance until they do.

G-QRP-CLUB CW ACTIVITY WEEKEND

Starts: 0900 GMT September 12
Ends: 2300 GMT September 13

All radio amateurs interested in QRP are invited to take part in the club's activity weekend. No special exchange information was mentioned in the information provided by the club. The operating schedule for this weekend is as follows:
3560 kHz = 0900-1000, 1700-1800, and 2200-2300 GMT;
7030 kHz = 1200-1300, 1500-1600, and 1900-2000 GMT;
14060 kHz = 1000-1100, 1400-1500, and 2100-2200 GMT;
21060/28060 = 1100-1200, 1600-1700, and 2000-2100 GMT.

Reports on the Activity Weekend will be welcomed by Christopher J. Page G4BUE.

MARYLAND-DISTRICT OF COLUMBIA QSO PARTY

Starts: 1900 GMT September 19
Ends: 1900 GMT September 20

Sponsored by the Columbia Amateur Radio Association, the contest is open to all single-operator stations.

EXCHANGE:

QSO number, RS(T), and state, province, country, or MD county. Remember that Baltimore and Washington are independent cities!

SCORING:

MDC stations multiply total QSOs by sum of MD counties, states, provinces, and countries. Others multiply MDC QSO total by number of MD counties and independent cities (25 maximum). Also, multiply score by 1.5 if running 200 Watts or less.

FREQUENCIES:

Phone—3950, 7250, 14290, 21390, 28590; CW—60 kHz up from low end; Novice—3720, 7120, 21120, 28120.

AWARDS AND ENTRIES:

Plaques and certificates for top scores in each category. Mail entry by October 20th to CARA, Inc., c/o Robert K. Nauman WA3VUQ, 4017 Font Hill Drive, Ellicott City MD 21043.

COLLEGE SCRIMMAGE

Starts: 0200 GMT September 19
Ends: 0400 GMT September 20

The idea of this contest is to put long-lost alumni in touch with their alma mater. Entry classes include alumni and college stations (one transmitter only). Exchange name of college, Jr. college, or university you last attended, and the last years of the year you graduated or will graduate. Club stations substitute "Amateur Radio Club" for number. Non-collegians, substitute "high school" for college name. Stations may be worked once per band. Multiply total QSOs times number of different colleges, Jr. colleges, and universities worked. Logs must be received by November 1st. Send to Penn State ARC (K3CR), 202 Engineering Unit E, University Park PA 16802. Please include an SASE for results.

FREQUENCIES:

SSB—1815, 3895, 7230, 14280, 21355, 28560; CW—60 kHz from low end; Novice—25 kHz from low end.

CAN-AM CONTEST

Phone
Starts: 1800 GMT September 19
Ends: 1800 GMT September 20
CW
Starts: 1800 GMT September 26
Ends: 1800 GMT September 27

Multi-operator stations can operate the full 24-hour period. Single-operator stations can operate a maximum of 20 hours with a maximum of two rest periods totaling a minimum of 4 hours.

Sponsored by the Ontario Contest Club and Canadian DX Association to increase the friendship among Canadian and American amateurs and to provide a means of measuring the performance of their operating skills and equipment.

Operating categories include: (1) Single operator—all bands with station operated by the station licensee; (2) Multi-operator, single transmitter—stations operated by more than one operator, or single operator other than the licensee, or club station; (3) club competition.

Use all bands, 160 through 10 meters. USA General portion of the bands is recommended. The same station can be contacted once on each band. Stations operating from outside of their own call area must sign slash and the area they are operating from.

EXCHANGE:

RS(T) plus sequential QSO number starting with 001 and multiplier (MX) area abbreviation (in that order). Multiplier-area abbreviation is the usual two-letter postal abbreviation for 50 US states, CN for Caribbean (KC4, KG4, KP1, KS4, KV4), PC for Pacific (rest of US possessions). Canadians will use: NF for VO1 and VO2, NB for VE1 New Brunswick, NS for Nova Scotia, PE for Prince Edward Island, SI for Sable and St. Paul Islands, PQ for VE2, ON for VE3, MB for VE4, SK for VE5, AT for VE6, BC for VE7, NW for VE8 NWT, and YU for VY1 Yukon.

SCORING:

The multipliers are the 50 US states, 2 US possessions (Caribbean & Pacific), 10 Canadian provinces, 2 territories (NWT & YU), 1 island (Sable or St. Paul). Total of 65 multipliers per band, maximum possible on all 6 bands is 390.

QSO points for Americans to Americans or Canadians to Canadians is 2 points per QSO. American to Canadian and vice versa counts 3 points per QSO. The final score is the result of the total QSO points from all bands, multiplied by the sum of the multipliers from all bands. Phone and CW sections of the contest are considered separate contests. However, combined score for phone and CW will be used for overall competition. Combined scores will be calculated by the contest committee as a result of the addition of the phone and CW scores.

AWARDS:

First-place certificates will be awarded in each multiplier area on both modes in single-operator categories. Top five multi-operator stations will receive certificates for high claimed phone and CW scores. All scores will be published in *CQ Magazine*. One year subscriptions to *Long Skip*, the CANADX bulletin, will be awarded to the 5 US stations. Additional trophies and plaques will be awarded the overall winners for the Canadian and American champions on phone, CW, and combined. Also, an award for the club having the highest score as a result of adding the 5 best scores on phone and CW by its members. A club officer must submit the summary showing the callsigns and

scores. Each station is eligible for one trophy only. In cases where one station qualifies for another trophy, the less significant trophy goes to the next eligible station.

ENTRIES:

All times must be kept in GMT. Indicate multipliers the first time only on each band. Log must be checked for duplicate contacts, correct QSO points, and multipliers. Do not use separate logs for each band. Rest periods must be clearly marked in the log. Each entry must consist of: log sheets, summary sheet showing all scoring information, category of competition, operator's name and callsign, address of the station, and signed declaration. Entries with over 200 QSOs must include check sheets for each band. Official logs, check sheets, and summary sheets with multiplier tables are available from the contest chairman; a large SASE with Canadian stamps (for US stamps *not glued to the envelope*) will bring you samples. Usual disqualification rules apply, and the decisions or actions of the Can-Am Contest Committee are official and final. All entries must be postmarked not later than 30 days after the contest and mailed to: VE3BMV, PO Box 292, Don Mills, Ontario, Canada M3C 2S2.

DARC CORONA 10-METER RTTY CONTEST

Contest Period: 1100 to 1700 GMT September 26

This is the third of four tests during the year sponsored by the DARC eV to promote RTTY activity on the 10-meter band. Each of the four tests is scored separately. Use the recommended portions of the 10-meter band.

EXCHANGE:

RST, QSO number, and name.

SCORING:

Each station can be contacted only once. Each completed 2 x RTTY QSO is worth 1 point. Multipliers include the WAE and DXCC lists and each district in W/K, VE/VO, and VK. The final score is the total number of QSOs times the total multiplier.

AWARDS:

Plaques will be awarded to the leading stations in each class with a reasonable score present. Operating classes include: Class A for single- or multi-operator stations and Class B for SWLs.

ENTRIES:

Logs must contain name, call, and full address of participant. Also show class, times in GMT, exchange, and final score. SWLs apply the rules accordingly. Logs must be received within 30 days after each test. Send all entries to: Klaus K. Zielski DF7FB, PO Box 1147, D-6455 Erlensee, West Germany.

The remaining contest period is on November 8th.

MAINE QSO PARTY

Starts: 2300 GMT September 26
Ends: 2359 GMT September 27

Sponsored by the Portland Amateur Wireless Association, the contest is open to all. Stations may be worked once on phone and once on CW, for each band.

EXCHANGE:

RS(T), serial number, and state, province, country, or Maine county.

FREQUENCIES:

SSB—1815, 3930, 7280, 14280, 21380, 28580; CW—1805 and 55 kHz up from low end of band; Novice—3720, 7120, 21120, 28120.

SCORING:

Complete QSOs count 3 points. Out-of-state stations multiply the total number of QSO points by the number of Maine counties contacted (maximum of 16). Maine stations multiply the total number of QSO points by the sum of Maine counties, states, provinces, and countries.

ENTRIES:

Mail entries by December 1st to PAWA, Box 1605, Portland ME 04104. Applications for the Worked All Maine Counties award may go to the same address.

HAM HELP

I need a schematic and service manual for an HF receiver unit of Model RBM-3 radio equipment type CCT-46077. I will pay for schematic/manual (or copy) or I can copy and return original. Thank you.

Larry Steele K8UKO
5060 Chickweed Dr.
Colorado Springs CO 80917

I need instruction manuals for the Realistic DX-160 and the Allied Radio 2589 receiver. I will pay postage for photocopies or originals. I also need a Knight T-60 transmitter unit and schematic.

Kevin Neal
Rte. A, Box 221A
Flippin AR 72634

I need some help in obtaining the following books: *Radiotelegraph Operator's License Q&A Manual* by Milton Kaufman and *Radio Operating Questions & Answers*, 15th Ed, 1977, by Jules L. Hornung and Alexander A. McKenzie. I will gladly pay for these books if someone could provide me with a source for them. Also, if there are any Maritime Radio Officers going to be in port in Athens, Greece, drop me a line. Thanks.

SSG Gary S. O'Neal
HHD, 558th USAAG
APO NY 09253

I desperately need a source of tubes for my linear. It uses surplus-type RK-65s. If anyone can help me I will certainly appreciate it. Thanks.

Larry Ennis K8AXS
394 Leota
Union Lake MI 48085

I would like very much to obtain an instruction, operator's, or service manual for a DSI frequency counter, model no. 3600. This unit was manufactured by Diversified Security Industries, San Diego CA 92111. I think that perhaps the company has gone out of business; my letters have been returned. Can anyone help me out?

Mr. Lawrence Neel, Jr. W8PKV
1236 Bondick Dr.
Cincinnati OH 45230

I need a manual and schematic on an Itron model 680 frequency counter/timer. I will pay for manual or copy or will copy and return. Any help will be appreciated.

J. O. Dickinson W4LLF
1408 Monmouth Court West
Richmond VA 23233

CORRECTIONS

There is an error in my article on the Robot 800H specialty terminal in the August, 1981, issue. On page 92, column 4, the sentence begun in the seventh line from the bottom should read: "Word mode sends each word as it is completed *when* the Model 800 detects a space."

Wayne E. Elseth WB9PKD
Carbondale IL

In my review of *Guide to RTTY Frequencies* in the August, 1981, *73*, my address was incorrect. The street address should be *204* Dellwood Drive.

Dennis G. Brewer K8DIU/4
Greenville NC

NOISE BRIDGE PARTS KIT

A complete kit of parts, including PCB and cabinet, for a noise bridge similar to the one shown in Fig. 2, p. 41, of the August issue, is available for $31.95 plus $2.50 shipping from Radiokit, Box 4115, Greenville NH 03048. The bridge covers 1.5 to 30 MHz with a resistive range of 0 to 250 Ohms and a reactive range of −180 to +180 Ohms.

DS2050 *from page 42*

mind. All functions are keyboard-controlled, involving pressing the control key and one of the keys on the top row of the keyboard. Unshift-on-space can be selected in the Baudot mode and automatically resets the receive circuitry to LTRS (letters) case when a space character is received. Sync idle (often referred to as "diddle") can be switched on or off in all modes, and causes a non-printing character to be transmitted when your typing rate is slower than the transmit-output rate.

Unlike mechanical RTTY terminals, the DS2050 does a lot of the drone work for you. Start typing, and it keys the transmitter. Stop, and the transmitter shuts off. Word wrap-around is provided in both transmit and receive. In transmit, if you are typing along and come to the end of the line, the computer will bump the word to the next line and insert a carriage return, line feed, and LTRS shift. In addition, when the ENTER key is pressed, a carriage return, line feed, and LTRS shift is generated. In receive, whenever a line feed is received, a carriage return is performed as well. What all this boils down to is that you sit there and type your message and the computer takes care of the rest.

Test messages are generated by pressing CONTROL and one other key. Hit the RY key, and an entire line of RYRY will bless the eyes and ears of others on the same frequency. The same with the traditional Quick-Brown-Fox message. The CQ button generates a bunch of CQs in the blink of an eye. These are augmented by two 32-character ID message buffers which must be loaded each time the system is turned on. The first buffer is used also for the CW ID, so I usually program a short message like DE KA1LR into that. The second buffer is used only for RTTY ID, so I often program something like KA1LR "PAUL" HARRISVILLE NH.

The ability to type a message for transmission while receiving (pretyping) is almost a necessity, and the 2050 can do it, although in a limited fashion. There is a hidden buffer that will hold 255 characters, and it can be typed into at the same time you are receiving a message.

Transmitted text is printed dimmer on the screen than received text, and you can type straight in while receiving, but since it mixes the transmit text in with the receive text, it makes it all a little hard to read. Mind you, it will be sent correctly—it just looks a little strange. In short, the 2050 offers two varieties of pretyping, but neither is quite as convenient as terminals with split-screen operation.

If your typing is as bad as mine, you'll appreciate the DS2050's approach to sending text. It is word-oriented and always stays at least one word behind your typing. As you type a sentence, if you are typing slower than the unit can send, it will stop before the word you are typing and wait until you hit the space bar to send it. This allows you to go back and correct spelling mistakes before the word goes out. A nice touch!

The receive mode works beautifully. The ST5000 demodulator can decode tones I can barely hear and dutifully ignores a fairly high level of QRM. It will tune either 170- or 850-Hz shifts, so you'll be at home both on the HF bands and two meters. Tuning is easily accomplished with the large meter on the top of the unit. Pick up a cheap scope at the next hamfest, and you'll be able to plug it into the 2050 and tune even more accurately.

For those of us who like to leave our equipment on all of the time and tuned to a specific frequency, autostart is included. Both mark and space tones must be present for 3.5 seconds before anything will appear on the screen, effectively preventing garbage from being printed. You'll need a standard teleprinter with loop keying for hard copy if you don't want to miss anything!

Keeping track of the status of all the functions is rather important. The top line of the screen serves as a status indicator, and I find myself looking at it frequently to make sure I'm using the right code, speed, and transmit mode. Unfortunately, one of the two things I don't like about the 2050 involves the status line. It is bumped off when the screen fills with text, and to get it back, you must enter a control code. The status line will disappear again as soon as another line of text is started. No doubt this was done to allow as much text as possible to appear on the screen at one time, but I suspect most of us would gladly sacrifice a line of text to see the status line there all the time.

The other thing I would like to see changed is the number of options we have for keying a transmitter. Currently, you can transmit RTTY anyway you like as long as it is AFSK. Adding TTL- and RS232-level FSK is an easy modification since both are present on the demodulator board. Pick up the signal your rig needs off the board, bring it out to a phono jack on the back panel, and you'll be enjoying the benefits of direct FSK. Considering the large number of transceivers that include an FSK circuit, it would be nice if HAL made FSKing more accessible in future evolutions of the box.

RTTY equipment manuals have generally been better than those supplied with other amateur equipment, and the 57-page tome packed with the DS2050 is no exception. It could easily serve as a textbook for those who know absolutely nothing about RTTY. The instructions for the terminal itself are very complete, but HAL goes on to explain the theory behind RTTY, how to choose a transmitter and receiver for RTTY, how to tune signals, and even how to interface your standard TV set to the terminal.

On The Air

The DS2050 looks pretty good on paper, but it does even better in actual use. It's amazing how annoying even minor glitches can be in a piece of ham gear, but my blood pressure has stayed at normal levels throughout the months I've had the HAL. The keyboard has a satisfying feel and there is absolutely no keybounce. The RFI that has plagued some of the computer/interface combinations I have used is completely absent. If you have never tried sending CW on a keyboard, you owe yourself a session on this machine. You type at any speed you like, and out comes perfectly-spaced CW. Hard to beat! We didn't test the CW-receive option, but for those who are interested, it's available.

Turning to RTTY, the phrase that immediately comes to mind is "rock-solid." The demodulator that HAL included may not be the fanciest board available, but it has never let me down, and the various control functions are so easy to use that you don't even need a cheat sheet to re-

member what does what.

The DS2050 is tailor-made for the ham who wants a high-performance RTTY/CW terminal at a reasonable price. Best of all, the circuitry is straightforward enough to allow us compulsive hardware hackers to enjoy ourselves without getting into too much trouble. If you are looking for SELCAL, message buffers, mailbox operation, or WRU, you'll want to look at one of the more expensive stand-alone units, or a computer/interface combination. For good basic performance that doesn't require a lot of fussing and cussing, you won't find a better deal than the HAL DS2050. For more information, contact *HAL Communications Corp., Box 365, Urbana IL 61801.* Reader Service number 477.■

FRG-7700 *from page 30*

sufficient to fire the imagination of all but the most jaded ham or SWL. Separate terminals are provided for shortwave and medium-wave antennas, as well an an SO-239 connector for shortwave antennas fed with 50-Ohm coaxial cable. Unfortunately, the shortwave and medium-wave antennas cannot be connected at the same time, so you have to mess around behind the rig every time you want to do a bit of broadcast-band DXing. Not to be neglected is the mute terminal, allowing the rig to be used easily with a transmitter.

Relay outputs from the clock are provided in phono-jack form, one with normally-open contacts, the other with normally-closed. Timer control of a tape recorder is a snap, banishing the usual kludge of control wires and relays forever. A DIN-plug accessory socket allows access to agc voltage, ground, mute output, and 11 V dc. There are no suggestions for the use of this socket in the instruction manual, but you can surmise that it might be used with an accessory preamp or converter. The receiver is equipped with a hefty three-wire line cord, and travelers will appreciate the four-position ac voltage selector. It is with great sadness that I report the lack of a dc power input. A cursory examination of the schematic offers little hope for a simple mod to allow operation from a 12-V dc power source. If, like me, you dream of having a general-coverage receiver bouncing around beneath the dashboard of your automobile, you'll have to look elsewhere. The final two items of interest on the rear panel are the external speaker jack and a switched front-end attenuator.

In Use

The proof of the pudding is, of course, not what goes into the dish, but how well it fares on the table. The Yaesu FRG-7700 does very well, thank you! How such a radio turns out depends to a great extent on the design philosophy of its engineer(s), and whoever is responsible for this receiver generally made all the right decisions. For example, many general-coverage receivers are designed to be used with minimal antennas. When faced with a real antenna, they often manifest an embarrassing array of overload-related problems. Connected to the 30-foot length of wire supplied with the set, the 7700 performed far better than my Sony ICF-5900W, but it really comes into its own with a longwire or dipole attached. Sensitivity in the SSB mode is rated at 0.5 μV between 2 and 30 MHz, and operation gave no reason to question this figure.

The choice of three levels of AM selectivity is extremely helpful. When listening to strong stations like the BBC, the medium level seems just right. The narrow mode removes the various whistles and splatter that threaten to overcome weaker stations like Radio Cairo or Radio Free Grenada, but with a noticeable restriction of audio response. The wide mode was too wide for use in the shortwave spectrum, although domestic broadcast listeners should find it useful. Audio quality in general is good—a reasonable compromise between a desire for high fidelity and the need for intelligibility in a shortwave receiver. The tone control is of the high-cut variety, rolling off treble as it is turned counterclockwise.

For those hams who operate more phone than CW, the 7700 could serve as a very passable backup receiver. As mentioned earlier, a mute terminal is provided, allowing interface with most transmitters and transceivers. Four 1N60 diodes are used as a diode-ring product detector for SSB and CW demodulation. True, its 2.7-kHz selectivity in these modes will keep the 7700 from endangering sales of anyone's hambands-only equipment, but it is nice to know that the 7700 can be pressed into service in an emergency. As expected from a synthesized receiver, mechanical and electronic frequency stability was excellent. Minor earthquakes should cause no instability in this radio, and radioteletype aficionados won't be frustrated by tones that mysteriously drift out of the passband of their demodulators.

Certainly the most unusual feature of the FRG-7700 is its memory option. At first, I had some qualms about an accessory that cost more than the entire receiver I used previous to the 7700's arrival, but after using it, the digital memory feature has proved to be extremely useful. I program the first six memories with shortwave broadcast stations that I listen to in the morning, and the other six with stations I like to hear at night. I am a confirmed BBC addict, so four of the 12 memories contain BBC frequencies, which allows me to instantly select the one that suffers the least interference and has the best path to my part of the country at any particular time. Broadcast DXers looking for a rare and hard-to-hear station might program a couple of frequencies where the station should appear, and check back frequently to see if it is readable. Best of all, these memories are retained if you unplug the radio to move it or the power fails, as long as you install three penlight cells in the holder accessed through a port in the bottom of the radio.

While the memory unit is an extremely useful accessory, it could stand some improvement. An annoyingly loud transient occurs whenever the Memory switch is rotated or the MR button is pushed. Moreover, alignment of the circuitry is rather critical—after using the receiver for a while, it no longer memorized the exact frequency I wanted. It would be either 100 Hz high or 100 Hz low. Resolution of the problem involves a simple adjustment inside the rig, but it would be nice if it weren't necessary at all. Even with these shortcomings, the digital memory option is an extremely useful feature, and for many it will

See List of Advertisers on page 114

be worth the extra cash demanded for it.

The noise blanker performed as expected, with time constants designed for suppression of ignition noise, rather than the woodpecker. The agc action was just right, without the extremely long hang times found on certain competitive receivers. The attenuator is a variable control with most of its action at the beginning of its travel. The control quickly arrives at an unusably high level of attenuation, and it would be nice to see the range of control expanded a bit, even if it does lessen the ultimate attenuation somewhat.

While it may be a small loss, the function of the analog dial is mostly cosmetic. It is easily knocked out of calibration while tuning and, consequently, is of questionable value. About the only use I could think up for it is keeping rough track of where the main dial is when the digital readout is displaying a memory frequency. Happily, the digital dial works beautifully, and when I use the 7700 as a clock radio, its warm brown glow doesn't keep me awake like some of the blue displays I have seen.

One little-known accessory that I find extremely useful is the FRT-7700 antenna tuner, designed specifically for use with the 7700 receiver. The 7700 is very sensitive to antenna impedance, and the tuner can peak up the signal from a mismatched antenna by several S-units. Unless you have cut a dipole for every band that you listen to, the tuner is good to have inline. For those of us with overload problems, there is a zero-to-60-dB attenuator, and the separate 150-to-500-kHz antenna input has a two-section low-pass filter to reject shortwave broadcast signals. Beyond such practical considerations, the tuner is a very attractive box of parts, and its price tag is low enough to assuage any guilt over the slight self-indulgence.

If you frequently read the reviews in this magazine, you will know that we complain about the quality of a lot of the manuals that are provided with the ham equipment we see. Yaesu's manuals have been steadily improving and the one packed with the 7700 is excellent. The installation and use section is well written, and the novice ham or beginning shortwave listener will appreciate the section on the basics of radio propagation. Large foldout schematics are printed on heavy paper, and there are circuit descriptions, maintenance and alignment procedures, and a complete parts list.

Conclusion

The FRG-7700 is a receiver that I can easily recommend to anyone who is looking for a competent shortwave receiver for general use. It is as free from quirks and idiosyncrasies as one can hope for, comparing favorably with receivers that cost considerably more. For shortwave listening, broadcast DXing, and back-up use in the ham shack, this receiver is at the top of its class! For further information, contact *Yaesu Electronics Corp., 6851 Walthall Way, Paramount CA 90723.* Reader Service number 476. ■

FCC

Reprinted from the Federal Register

Frequency Allocations and Radio Treaty Matters; Amateur Radio Service; Rules To Revise Power Limitations in a Specific Frequency Band

AGENCY: Federal Communications Commission.

ACTION: Final rule.

SUMMARY: This document amends the Commission's rules to revise power and geographic restrictions for amateur radio stations operating in the 1800–2000 kHz band. This action was taken to relieve unnecessary operation restrictions.

EFFECTIVE DATES: June 10, 1981.

ADDRESS: Federal Communications Commission, Washington, D.C. 20554.

FOR FURTHER INFORMATION CONTACT: Nancy A. Krieger, Private Radio Bureau, Washington, D.C. 20554, (202) 632–4964—Room 5202(H).

SUPPLEMENTARY INFORMATION:

Order

Adopted: May 21, 1981.

Released: June 1, 1981.

By the Commission: Chairman Fowler abstaining from voting; Commissioner Jones absent.

In the Matter of Amendment of Rule Sections 97.61(a) and (b)(2) of the amateur radio service rules to revise power limitations in the 1800–2000 kHz band; amendment of § 2.106, table of frequency allocations; FCC 81–231.

1. On July 17, 1980, the Commission received a *Request for Agency Action* from the American Radio Relay League, Inc. (ARRL). The ARRL, in its Request, asked the Commission to delete § 97.61 (b)(1) and (b)(2) of the Amateur Radio Service Rules by issuance of an Order. The ARRL believes that such an Order would greatly benefit the Amateur Radio Service community by encouraging innovation and experimentation in the 1800–2000 kHz band (also known at the 160 meter band). Also, the ARRL states that these rule sections currently provide protection to long-range aid to radio navigation (LORAN–A) systems from amateur radio interference. Since LORAN–A is being terminated, the League feels there is no longer a need for § 97.61 (b)(1) and (b)(2). The Amateur Radio Service shares the 160 meter band on a secondary basis. § 97.61(b) places transmitter power and geographic restrictions on amateur radio operations in the 160 meter band to prevent interference to LORAN–A. The ARRL states that the Commission can amend its rules by Order because "Footnote NG15(b) . . . empowers the Commission to terminate the restrictions of Section 97.61 (b)(1) and (b)(2) . . . without the necessity of rulemaking or other procedural steps prescribed by the Administrative Procedures Act."

2. On November 26, 1980, the United States Coast Guard sent a Memorandum to the Secretary for the interdepartment Radio Advisory Committee (IRAC) stating that the Coast Guard planned to cease LORAN–A operations in the United States by the end of 1980.

PART 2—FREQUENCY ALLOCATIONS AND TREATY MATTERS; GENERAL RULES AND REGULATIONS

Appendix

A. Part 2 of Chapter I of Title 47 of the Code of Federal Regulations is amended, as follows:

In Section 2.106, under the heading NG Footnotes, amend Footnote NG 15 subparagraph (a)(4) by the existing Table and adding the following Table:

§ 2.106 Table of frequency allocations.

* * * * *

NG Footnotes

* * * * *

NG 15 (a) * * *

(1) * * *

(2) * * *

(3) * * *

(4) * * *

State(s)	Maximum DC plate input power in watts (kilowatts)			
	1800 to 1825	1825 to 1850	1850 to 1875	1875 to 2000
	Day/night	Day/night	Day/night	Day/night
Maine, Massachusetts, New Hampshire, Rhode Island	100/25	0	0	100/25
Connecticut, Delaware, Maryland, New Jersey, New York, Pennsylvania, Vermont	200/50	0	0	200/50
Kentucky, North Carolina, Ohio, South Carolina, Tennessee, Virginia, West Virginia	500/100	0	0	500/100
Florida, Georgia, Illinois, Indiana, Michigan, Wisconsin	500/100	100/25	100/25	500/100
Alabama, Arkansas, Iowa, Minnesota, Mississippi, Missouri	1000/200	200/50	200/50	1000/200
The remainder of the States and territories	1000/200	1000/200	1000/200	1000/200

PART 97—AMATEUR RADIO SERVICE

B. Part 97 of Chapter I of Title 47 of the Code of Federal Regulations is amended, as follows:

1. In Section 97.61 paragraph (a) is amended by removing the first line of the Table and replacing it with the following two lines:

§ 97.61 Authorized frequencies and emissions.

(a) * * *

Frequency band	Emissions	Limitations (see paragraph (b))
1800 to 1900	A1, A3	
1900 to 2000	A1, A3	1, 2

* * * * *

2. In Section 97.61 subparagraph (b)(2) is amended by removing the existing Table and replacing it with the following Table:

§ 97.61 Authorized frequencies and emissions.

* * * * *

(b) * * *

(1) * * *

(2) * * *

State(s)	Maximum DC plate input power in watts (kilowatts)			
	1800 to 1825	1825 to 1850	1850 to 1875	1875 to 2000
	Day/night	Day/night	Day/night	Day/night
Maine, Massachusetts, New Hampshire, Rhode Island	100/25	0	0	100/25
Connecticut, Delaware, Maryland, New Jersey, New York, Pennsylvania, Vermont	200/50	0	0	200/50
Kentucky, North Carolina, Ohio, South Carolina, Tennessee, Virginia, West Virginia	500/100	0	0	500/100
Florida, Georgia, Illinois, Indiana, Michigan, Wisconsin	500/100	100/25	100/25	500/100
Alabama, Arkansas, Iowa, Minnesota, Mississippi, Missouri	1000/200	200/50	200/50	1000/200
The remainder of the States and territories	1000/200	1000/200	1000/200	1000/200

However, LORAN–A operations by other countries may continue until December 31, 1982.[1] The Coast Guard recommended changes to Section 97.61 (b)(1) and (b)(2) of the Commission's Rules. The IRAC approved the Coast Guard plan and forwarded it to the Commission in December, 1980. The Commission can incorporate the Coast Guard recommendations for § 97.61(b)(2) into its Rules. However, we must retain Rule Section 97.61(b)(1) since protection should still be provided for LORAN–A stations operated by Canada.

3. Therefore, by this Order, Rule Section 97.61(a) is revised to reflect a reduction in the restrictions on amateur radio operation in the 160 meter band. Rule Section 97.61(b)(1) remains because amateur radio stations should not interfere with the remaining LORAN–A operations. The Table in Rule Section 97.61(b)(2) is revised to reflect the new power limitations for amateur radio operation in the 160 meter band. In addition, we are amending Rule Section 2.106, Table of Frequency Allocations, Footnote NG15(a)(4) to reflect the new power limitations for amateur radio operation in the 160 meter band.

4. The 1979 World Administrative Radio Conference (WARC) in Geneva, decided that Loran–A operations in the 160 meter band in Region 2 (the Americas) would terminate by December 31, 1982. It made an exclusive allocation to the amateur radio service at 1800–1850 kHz and a shared allocation to the service as one of five primary services at 1850–2000 kHz. However, the Final Acts of the Conference are not scheduled to become effective until January, 1982 for those countries who have ratified the treaty. Further, after the United States does ratify the treaty, public consultation may be necessary through the rulemaking process before specific provisions can be incorporated into the domestic Rules. Therefore, the rule amendments adopted in this Order may be effective only for a short interim period.[2] Consequently, Amateur radio operators are cautioned not to invest heavily in equipment which can only be used for this frequency band because there is no guarantee as to the final provisions for the Amateur Radio Service in the 160 meter band.

5. The specific rule amendments that we are adopting are set forth in the Appendix. Authority for the amendments is contained in Sections 4(i) and 303(r) of the Communications Act of 1934, as amended. We are dispensing with the prior notice and public procedures provisions of the Administrative Procedures Act as impracticable (see 5 U.S.C. 553(b)(3)(B) in view of the short period of time that these frequencies are likely to be available.

6. Accordingly, it is ordered effective June 10, 1981 that Parts 2 and 97 of the Commission's Rules are amended as set forth in the attached Appendix.

7. It is further ordered that this proceeding is terminated.

8. Information concerning these rule changes may be obtained from John B. Johnston, (202) 632–4964.

(Secs. 4, 205, 307, 48 Stat., as amended, 1066, 1082, 1083; 47 U.S.C. 154, 303, 307)

Federal Communications Commission.
William J. Tricarico,
Secretary.

[1] See discussion of results of 1979 World Administrative Radio Conference in paragraph 4.

[2] The First Notice of Inquiry in Docket No. 80-739, Implementation of the Final Acts of the World Administrative Radio Conference, proposed an exclusive allocation to the amateur service at 1825–1850 kHz and an exclusive allocation to the radiolocation service at 1900–2000 kHz, along with suppression of the footnote NG15.

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

It is hard to believe, but two years have passed since our initial announcement of the famous *73 Magazine* Awards Portfolio. During this period, we've seen the program grow significantly to become one of the most sought-after challenges facing amateurs today.

Consisting of six domestic incentives and five DX achievement programs, the awards portfolio has captured the interest of almost everyone on the bands, whether you are a rag chewer or a big-time contester.

In the paragraphs to follow, I am listing the awards individually. Read through the rules with caution. The requirements are not as easy as one might first imagine. We want our award recipients to realize they had to *earn* their recognition, and therefore have designed each award to be somewhat of a challenge. Here are the five DX awards.

73 DX COUNTRY CLUB AWARD

1. Sponsored by the editors of *73 Magazine*, the 73 DX Country Club Award is available to licensed amateurs throughout the world.

2. To be valid, all contacts claimed must be made in a *single calendar year* (January 1 through December 31), beginning January 1, 1979.

3. This award is issued for All Phone, All CW, and Mixed Modes. Should the applicant wish to recognize a single-band or mixed-band accomplishment, merely state your request when submitting your application.

4. To qualify for any of the *73* DX Country Club Awards, a minimum of 73 DX countries must be worked and confirmed from the *73 Magazine* WTW (Work the World) DX Listing which appears elsewhere in this column. Once again, all contacts must be made in the same calendar year for which application is made.

5. Annual endorsement stickers are available for each succeeding year in which application is made and showing a minimum of 73 countries worked.

6. To apply, prepare a list of claimed contacts in prefix order. Include each station's callsign, date and time in GMT, mode, and band of operation.

7. Do not send QSL cards! Have your list of contacts verified by two amateurs, a local club secretary, or by a notary public.

8. Award fee is $4.00 or 12 IRCs for each award. Endorsements are granted for a fee of $2.00 or 6 IRCs.

9. *For All 73 award applications: Enclose your verified list and award fee(s) to: Bill Gosney KE7C, 73 Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island, Washington 98277 USA.*

DX CAPITALS OF THE WORLD AWARD

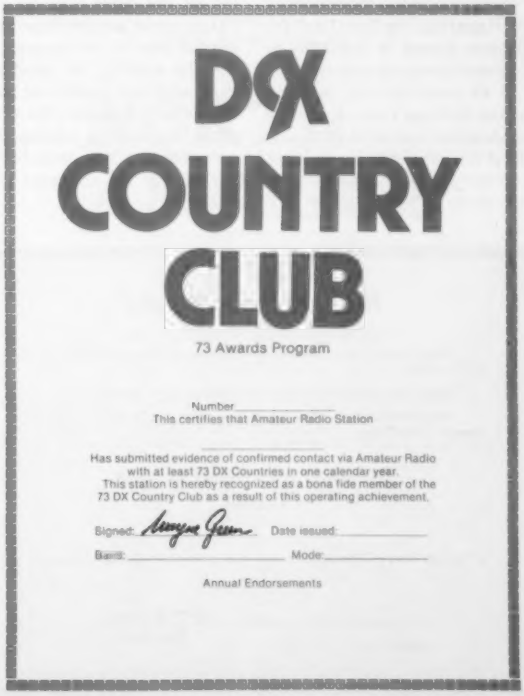
1. Sponsored by the editors of *73 Magazine*, the DX Capitals of the World Award is made available to licensed amateurs the world over.

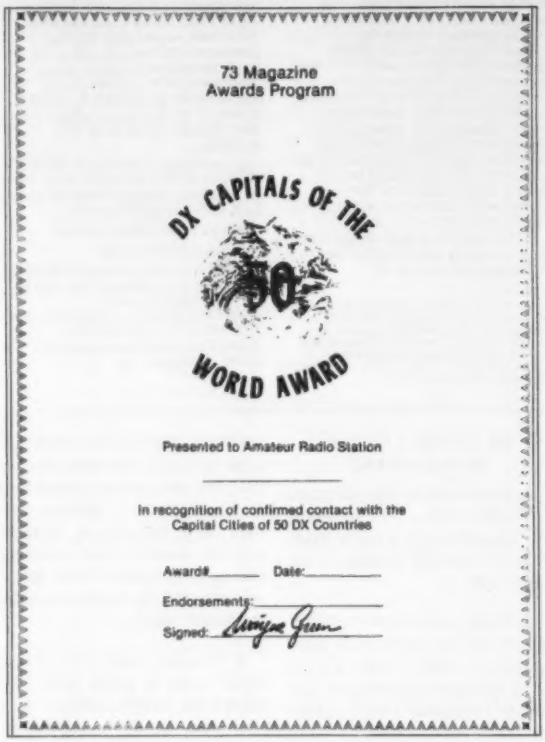
2. To be valid, all claimed contacts must be made on or after January 1, 1979. There are no band or mode restrictions, but special recognition will be given for single band or mode accomplishments if requested in the application.

3. To qualify, applicants must work and confirm fifty (50) different capital cities of the world. Only capitals of those countries which appear on the WTW DX Listing qualify. Should a country be contacted and its capital city is not commonly known, you may list it on your application and the awards editor reserves the right to make a final determination as to its acceptance for award credit.

4. To apply, make a list of contacts made in prefix order. Indicate the station callsign, date and time in GMT, band and mode of operation, the name of the capital city, and the DX country.

5. Do not send QSL cards! Have your list of contacts verified by two amateurs, a radio


DX
COUNTRY
CLUB
73 Awards Program
Number
This certifies that Amateur Radio Station
Has submitted evidence of confirmed contact via Amateur Radio with at least 73 DX Countries in one calendar year. This station is hereby recognized as a bona fide member of the 73 DX Country Club as a result of this operating achievement.
Signed:
Date issued:
Band:
Mode:
Annual Endorsements



club secretary, or a notary public. The award fee is $4.00 or 12 IRCs.

TEN-METER DX DECADE AWARD

1. Sponsored by the editors of *73 Magazine*, the Ten-Meter DX Decade Award is available to licensed amateurs worldwide.

2. All contacts must be made on the 10-meter band using only channelized converted Citizen-Band equipment or similar type commercial units operating a maximum of 15-Watts PEP output. External amplifiers may not be used.

3. To be eligible for this award, all contacts must be made on or after October 1, 1978. Contacts may be claimed for all AM, SSB, CW, or FM. Mixed-mode accomplishments are not valid for this award.

4. To qualify, the applicant must work and confirm at least ten DX countries from the WTW (Work the World) Listing. Endorsements will be given for 25, 50, 75, and 100 countries confirmed.

5. To apply, make a list of contacts claimed, giving the callsign of each station worked in prefix order. Include the date and time in GMT, band, mode, and a brief description of the equipment used in making each contact. Special recognition will be given for QRP mobile achievements.

6. Do not send QSL cards! Have your list of contacts verified by two amateurs, a local radio club secretary, or by a notary public. The award fee is $4.00 or 12 IRCs.

SPECIALTY COMMUNICATIONS ACHIEVEMENT AWARD—CLASS A-1

1. Sponsored by the editors of *73 Magazine*, this award is dedicated to amateurs worldwide who take pride in active participation in the field of specialty communications.

2. To be eligible for this award, some very rigid requirements must be met. All contacts must be made on or after January 1, 1980. Only communications via SSTV, RTTY, EME (Earth-moon-Earth), and/or OSCAR will be recognized for award credit. Contacts between stations on OSCAR and EME may be made using any mode authorized in your country. Applicants must be cautioned, however, that mixed-mode contacts are not valid.

3. To qualify, applicants must work a minimum of 10 DX countries from the WTW DX Listing. Special recognition will be made for those exceeding the 10-country minimum.

4. To apply, the applicant must prepare a list of claimed contacts in callsign prefix order. Include the date and time in GMT, the band and mode of operation, and a signed declaration as to the type and description of equipment and antenna system utilized to make your contacts.

5. Do not send QSL cards! Have your list verified by two amateurs, a local club secretary, or a notary public.

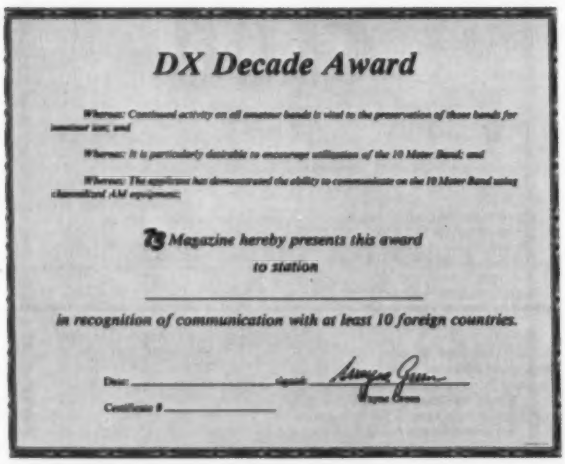
6. The award fee is $4.00 or 12 IRCs.

SPECIALTY COMMUNICATIONS ACHIEVEMENT AWARD—CLASS A

A significant number of amateurs throughout the world find their primary interest in the operation and development of specialty-type communications. It is the efforts of these many pioneers in their respective fields which have created many state-of-the-art improvements in technology today. The editors of *73* wish to recognize those amateurs who make positive steps toward expanding the use of their respective mode or type of amateur operation. As a result, in the paragraphs to follow, learn of our latest communications award, dedicated to "communicator specialists."

To be eligible for the award, all contacts must be made on or after January 1, 1980. In addition, only communications via SSTV, RTTY, EME (Earth-moon-Earth) and/or OSCAR satellite will be recognized for this award. Contacts between stations on OSCAR or EME may be made using any authorized mode allowed in your country. Applicants are cautioned however, that mixed-mode contacts are not valid.

To qualify, applicants must work and confirm contact with each of the 50 US states. There


DX Decade Award
Whereas: Continued activity on all amateur bands is vital to the preservation of those bands for amateur use; and
Whereas: It is particularly desirable to encourage utilization of the 10 Meter Band; and
Whereas: The applicant has demonstrated the ability to communicate on the 10 Meter Band using channelized AM equipment;
73 Magazine hereby presents this award
to station
in recognition of communication with at least 10 foreign countries.
Date:
Signed:
Certificate #

are no band requirements, but specific band accomplishments will be recognized if requested at the time of application.

To apply, applicant must prepare a list of claimed contacts in alphabetical order by state. Include the date and time in GMT, the band and mode of operation, and a signed declaration of the type and description of equipment and antenna system utilized.

Do not send QSL cards! Have your list verified by two amateurs, a local radio club, or a notary public. Enclose with your application a $4.00 award fee or 12 IRCs.

WORK THE WORLD DX AWARD

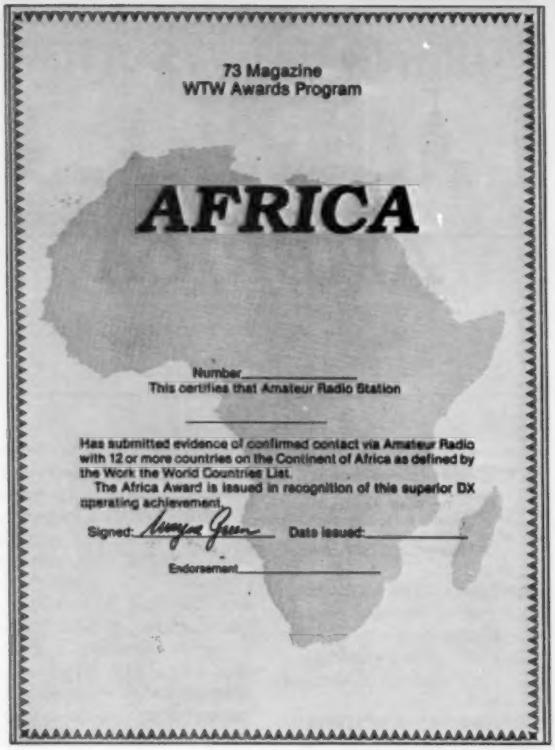
To enhance the enjoyment of working DX, the editors of *73 Magazine* take special pleasure in introducing the most complex and probably the most sought-after award in existence today—the Work the World DX Award.

1. The WTW Award is available to licensed amateurs the world over.

2. To be valid, all contacts must be made on or after January 1, 1979. There are no band or mode restrictions, but applicants will be given recognition for single-band or -mode achievements upon their request. Only DX countries shown on the WTW DX Listing qualify.

3. The Work the World program consists of six continental awards (North American, South American, European, Oceanic, Asian, and African), each of which is a worthy accomplishment on its own. Once application has been made for all six, the ultimate award, the Work the World DX Award, will be issued automatically without charge. The operator who earns WTW recognition has truly "worked the world."

4. Requirements for the individual Continental awards: North American Award—work 13 North American countries; South American Award—work 12 South American countries; European Award—work 12 European countries; Oceanic Award—work 12 Oceanic countries; Asian Award—work 12 Asian countries; African Award—work 12 African countries.

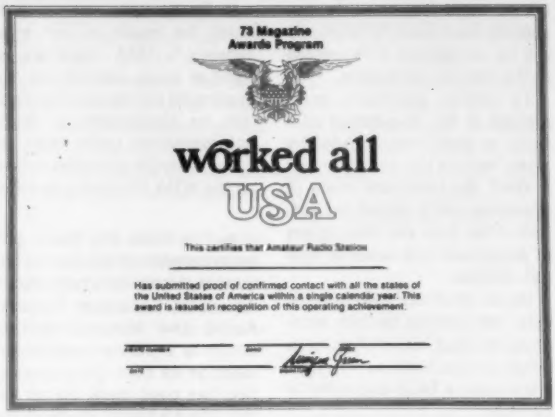

73 Magazine
WTW Awards Program
AFRICA
Number
This certifies that Amateur Radio Station
Has submitted evidence of confirmed contact via Amateur Radio with 12 or more countries on the Continent of Africa as defined by the Work the World Countries List.
The Africa Award is issued in recognition of this superior DX operating achievement.
Signed:
Date issued:
Endorsement

73 Magazine's
WTW Awards Program
WORK THE
WORLD AWARD
This document certifies that
Amateur Radio Station
has fulfilled the minimum requirements set forth in the rules of the Work the World Award by confirming contact with at least 73 DX Countries on the World's Six Continents, as follows:
13 North American Countries
13 South American Countries
12 European Countries
12 African Countries
12 Asiatic Countries
12 Oceanic Countries
In recognition of this remarkable and difficult accomplishment in DX operation, the Editors of 73 Magazine proudly issue this Award.
Date issued:
Award number:
Endorsements:
Signed:

73 Magazine
WTW Awards Program
OCEANIA
Number
This certifies that Amateur Radio Station
Has submitted evidence of confirmed contact via Amateur Radio with 12 or more countries of Oceania as defined by the Work the World Countries List.
The Oceania Award is issued in recognition of this superior DX operating achievement.
Signed:
Date issued:
Endorsements:

73 Magazine
WTW Awards Program
NORTH
AMERICA
Number
This certifies that Amateur Radio Station
Has submitted evidence of confirmed contact via Amateur Radio with 13 or more countries on the Continent of North America as defined by the Work the World Countries List.
The North America Award is issued in recognition of this superior DX operating achievement.
Signed:
Date issued:
Endorsements:

73 Magazine
WTW Awards Program
SOUTH
AMERICA
Number
This certifies that Amateur Radio Station
Has submitted evidence of confirmed contact via Amateur Radio with 12 or more countries on the Continent of South America as defined by the Work the World Countries List.
The South America Award is issued in recognition of this superior DX operating achievement.
Signed:
Date issued:


73 Magazine
Awards Program
worked all
USA
This certifies that Amateur Radio Station
Has submitted proof of confirmed contact with all the states of the United States of America within a single calendar year. This award is issued in recognition of this operating achievement.

5. To apply for any of these awards, prepare a list of claimed contacts for each continent, listing all callsigns in prefix order. Include date and time in GMT, and the band and mode of operation.

6. If you are submitting the sixth award application, please emphasize this fact to speed processing of your WTW Award.

7. Do not send QSL cards! Have your list(s) verified by two amateurs, a radio club secretary, or by a notary public.

8. Each Continental Award has an award fee of $4.00 or 12 IRCs.

Now here are the six domestic awards, also being sought after by award seekers the world over. These awards were not meant to be an overnight venture nor were they designed to duplicate any in existence today. Each offers its own degree of difficulty and creates a sense of accomplishment in those who are happy recipients.

WORKED ALL USA AWARD

Sponsored by the editors of *73 Magazine*, the Worked All USA Award is available to licensed amateurs throughout the world. To be valid, all contacts must be made on or after January 1, 1979. There are no band or mode restrictions, but single-band and single-mode accomplishments will be recognized.

If you're looking for an award with challenge, this definitely is one. To qualify, applicants must work *each of the 50 US states within the same calendar year* (January 1 through December 31). Annual endorsements will be awarded applicants who can verify their claim.

To apply, prepare a list of claimed contacts in alphabetical order by state, beginning with Alabama. List the state, the callsign of the station worked, the date and time in GMT, and the band and mode of operation.

Do not send QSL cards! Have your list of contacts verified by two amateurs, a local radio club secretary, or by a notary public.

The fee for the basic award is $4.00 or 12 IRCs; endorsements are $2.00 or 6 IRCs.

The Worked All USA Award, with its 12-month limitation, separates the men from the boys! To date, only a few have mastered the 80-meter band, while 10, 15, and 20 have been more popular. Only a few applicants have mastered all states on 6 meters, and 160 meters has been conquered only once. Does your station have what it takes to Work All USA in a calendar year?

THE Q-5 AWARD OF EXCELLENCE

If you frequent the American Novice bands, you will be pleased to hear of an exclusive award for these bands. Sponsored by the editors of *73 Magazine*, the Q-5 Award of Excellence is available to amateurs worldwide who meet the requirements.

To be valid, all contacts must be made on or after January 1, 1979. All contacts must be made operating the CW mode on those frequencies assigned the American Novice. Applicants are cautioned that power limitations are 250 Watts input. There are no band restrictions, but applicants may request special band endorsement on the award

73 Magazine
WTW Awards Program
EUROPE
Number
This certifies that Amateur Radio Station
Has submitted evidence of confirmed contact via Amateur Radio with 12 or more countries on the Continent of Europe as defined by the Work the World Countries List.
The Europe Award is issued in recognition of this superior DX operating achievement.
Signed:
Date issued:
Endorsements:

73 Magazine
WTW Awards Program
ASIA
Number
This certifies that Amateur Radio Station
Has submitted evidence of confirmed contact via Amateur Radio with 12 or more countries on the Continent of Asia as defined by the Work the World Countries List.
The Asia Award is issued in recognition of this superior DX operating achievement.
Signed:
Date issued:
Endorsements:

if the request is made at the time of application.

To qualify, applicants must work all ten US call districts and receive no less than a Q-5 report. A valid RST might be 559, 539, 579, etc., while an RST of 449, 349, or 479 would not qualify.

This award is not meant to be an overnight accomplishment. Stations meeting the challenge of these requirements will be proud to display this unique award depicting the excellence and superiority of the station's transmitted signal.

To apply, prepare a list of claimed contacts, logging each contact in order of the US call district. Include the station callsign, date and time in GMT, the frequency utilized, and, most important, the RST as noted on your confirmation card. Also required is a brief description of the station equipment and antenna system utilized to complete this award.

Do not send QSL cards! Have your list verified by two amateurs, a local radio club secretary, or a notary public. Enclose with your application the fee of $4.00 or 12 IRCs.

DISTRICT ENDURANCE AWARD

If any of our readers feel our awards are too soft for you, take a hard look at our next award! This one was designed to appear fairly simple at first glance, but it will drive you right up the wall with frustration as it is pursued. Known as the District Endurance Award, you'll need to find yourself an accurate timepiece, as you'll have exactly sixty (60) minutes to work all ten (10) US Call Districts! Simple, huh? Can you beat the best time to date—eight (8) minutes?

Sponsored by the *73 Magazine* editors, the District Endurance Award is offered licensed amateurs throughout the world. To be valid, all contacts must be made on or after January 1, 1979. There will be no band or mode restrictions, but if you are fortunate enough to work these requirements on a single band, we will be happy to recognize this feat when processing your award.

One of the most important rules applicable to this award is that all contacts must be made independent of nets, any net-type operation, or while any contest is underway.

To qualify, applicants must work all ten US call districts in one hour or less. The time will commence the moment the first contact is established and end with the time logged for the last district required.

To apply, applicants must prepare a signed declaration that all contacts were independent of net or contest operation. Applications must include a list of stations worked in callsign order by district, the date and time worked in GMT, the band and mode of operation, and the state.

Do not send QSL cards! Have your list of contacts verified by two amateurs, a local radio club secretary, or by a notary public. Accompanying your application should be a $4.00 award fee or 12 IRCs.

TEN-METER 10-40 AWARD

What would an awards program be like without a QRP incentive? With 10 meters at an all-time high, the editors of *73 Magazine* take pride in announcing the Ten-Meter 10-40 Award. Designed specifically for owners of converted Citizens-Band equipment, the Ten-Forty Award is probably the roughest worked-all-states award program in existence. Ask those who have tried numerous times and failed!

Available to licensed amateurs the world over, the award offers a challenge second to none. To be valid, all contacts must be made on the ten-meter band using only "channelized" Citizens-Band equipment or similar commercial units. Power is limited to 15-Watts PEP output. External amplifiers are prohibited.

To be eligible, all contacts must be made on or after October 1, 1978, on AM, SSB, CW, or FM modes. Mixed-mode contacts are not valid.

To qualify for this award, the applicant must work and confirm at least forty of the 50 US states. (An endorsement will be issued if all 50 states are worked.)

To apply, make a list of contacts in alphabetical order by US state beginning with Alabama. Include the call of the station worked, the date and time in GMT, the band and mode of operation, and a brief description of the equipment and antenna system utilized.

Do not send QSL cards! Have your list verified by two amateurs, a radio club secretary, or by a notary public. The award fee is $4.00 or 12 IRCs.

CENTURY CITIES AWARD

Designed as a Dual-Worked-All-USA effort, the editors present the Century Cities Award to the most demanding of amateur operators. The applicant who applies for this achievement realizes he has accomplished what is probably the greatest feat available in award programs today.

As with all *73*-sponsored awards (with the exception of the ten-meter incentives) all contacts must be made on or after January 1, 1979, to be valid.

To qualify, the applicant must work and confirm a minimum of two cities or towns in each of

73 Magazine
Awards Program
DISTRICT
ENDURANCE
AWARD
This certifies that
Amateur Radio Station
Has submitted proof of working all ten United States Call Districts
in one hour or less, having done so independently of contest, list
or net type operations, with a recorded time
of minutes.
In recognition of this achievement award number
is issued this date.
Endorsement:

the fifty US states, for a total of 100.

To apply, prepare a list of claimed contacts in alphabetical order, by state. As shown below, include the full callsign of the station worked, the date, the band, and the city. Beginning with Alabama, your list will look something like the following: Alabama—W4ZZZ, March 31, 1979, 14 MHz, Decatur; N4XXY, February 1, 1979, 21 MHz, Mobile; Alaska—KL7AB, January 22, 1979, 7 MHz, Anchorage; WL7WW, May 19, 1979, 28 MHz, Fairbanks; and so on.

Do not send QSL cards! Have your list of claimed contacts verified by two amateurs, a radio club secretary, or by a notary public. Enclose this list along with your award fee of $4.00 or 12 IRCs.

For applicants of the awards offered by *73 Magazine*: I would like to give you some insight on how we process the paperwork. Upon receipt of an application, each award requirement is carefully scrutinized to see that the applicant has met each one to the letter. If approved, an award work sheet is prepared. The original copy of this and applicable award fee is mailed to Peterborough NH for the *73* Art Department to process. It is there that your award is given a personal touch and later mailed to your door. A copy of the award work sheet is mailed to the applicant to acknowledge receipt of the application. (Should the applicant feel it necessary to follow up, he or she should write a letter to the Assistant Publisher, *73 Magazine*, Peterborough NH 03458. Writing directly to *73* headquarters will speed things up since the Awards Editor does

WTW DX LISTING

NORTH AMERICA

C6	Bahamas
CO	Cuba
FG	Guadeloupe
FG, FS	Saint Martin
FM	Martinique
FO	Clipperton Is.
FP	St. Pierre & Miquelon
HH	Haiti
HI	Dominican Republic
J3, VP2G	Grenada & Dependencies
KC4, KP1	Navassa Is.
KG4	Guantanamo Bay
KL7	Alaska
KP4	Desecheo
KP4	Puerto Rico
KS4, KP3, HK0	Serrana Bank and Roncador Cay
KV, KP2	Virgin Islands
OX, XP	Greenland
PJ6, 8	Saba Is.
VE	Canada
VE1	Sable Is.
VE1	St. Paul Is.
VO	Newfoundland, Labrador
VP2A	Antigua, Barbuda
VP2D	Dominica
VP2E	Anguilla
VP2K	St. Kitts
VP2L	St. Lucia
VP2M	Montserrat
VP2S	St. Vincent & Dependencies
VP2V	British Virgin Islands
VP5	Turks and Caicos Islands
VP9	Bermuda
W, K, N, A	United States of America
XE	Mexico
XF4	Revillagigedo Islands
ZF	Grand Cayman Islands
6Y	Jamaica
4U	HQ, United Nations
8P	Barbados

SOUTH AMERICA

CE	Chile
CE0A	Easter Is.
CE0X	San Felix
CE0Z	Juan Fernandez
CP	Bolivia
CX	Uruguay
FY	French Guiana
HC	Ecuador
HC8	Galapagos Is.
HK	Colombia
HK0	Bajo Nuevo
HK0	Malpelo Is.
HK0	San Andres & Providencia
HP	Panama
HR	Honduras
HR0	Swan Is.
KZ	Canal Zone
LU	Argentina
OA	Peru
PJ	Bonaire
PJ	Netherlands Antilles
PY	Brazil
PY0	Fernando de Noronha
PY0	St. Peter & St. Paul
PY0	Trinidade & Martim Vaz Is.
PZ	Surinam
TG	Guatemala
TI	Costa Rica
TI9	Cocos Is.
VP1	Belize
VP8	Falkland Is.
VP8, LU	South Georgia Is.
VP8, LU	South Orkney Is.
VP8, LU	South Sandwich Is.
VP8, LU	South Shetland Is.
VP8W	South Grahamland
YN	Nicaragua
YS	Salvador
YV	Venezuela
YV0	Aves Is.
ZP	Paraguay
8R	Guyana
9Y	Trinidad and Tobago

EUROPE

C3	Andorra
CT	Portugal
CT2	Azores
DA-DL	Federal Republic of Germany
DM, DT	German Democratic Republic
EA	Spain
EA6	Balearic Islands
EI	Republic of Ireland
EJ0	Aran Is.
F	France
FC	Corsica
G	England
GD	Isle of Man
GI	Northern Ireland
GJ, GC	Jersey
GM	Scotland
GM	Orkney Islands
GM	Shetland Islands
GU, GC	Guernsey
GW	Wales
HA	Hungary
HB	Switzerland
HB0	Liechtenstein
HV	Vatican
I	Italy
IC	Ischia
IA	Tuscan Archipelago
IS	Sardinia
IT	Sicily
JW	Bear Is.
JW	Svalbard Is.
JX	Jan Mayen
LA	Norway
LX	Luxembourg
LZ	Bulgaria
M1	San Marino
OE	Austria
OH	Finland
OH0	Aland Is.
OJ0	Market Reef
OK	Czechoslovakia
ON	Belgium
OY	Faeroe Islands
OZ	Denmark
PA	Netherlands
SM	Sweden
SP	Poland
SV	Greece
SV	Crete
SV	Dodecanese
SV	Mount Athos
TF	Iceland
UA, UK1, 3, 4, 6	European RSFSR
UA1, UK1	Franz Josef Land
UA2, UK2F	Kaliningradsk
UB, UK, UT, UY5	Ukraine
UC2, UK2	White RSFSR
UO5, UK5O	Moldavia
UP2, UK2B, P	Lithuania
UQ2, UK2G, G	Latvia
UR2, UK2R, T	Estonia
YO	Romania
YU	Yugoslavia
ZA	Albania
ZB	Gibraltar
3A	Monaco
4U	ITU, Geneva
9A	(See M1)

ASIA

A4X	Oman Is.
A5	Bhutan
A6X	United Arab Emirates
A7X	Qatar
A9X	Bahrain
AP	Pakistan
BV	Taiwan
BY	China
CR9	Macao
EP	Iran
HL, HM	North Korea
HL, HM	South Korea
HS	Thailand
HZ, 7Z	Saudi Arabia
JA-JR	Japan
JR6, KA6	Okinawa (Ryukyu Is.)
JD, KA1	Ogasawara
JT	Mongolia
JY	Jordan
KA	US Military in Japan
OD	Lebanon
S2	Bangladesh
TA	Turkey
UA, UK, UV, UW9-0	Asiatic RSFSR
UD6, UK6C, D, K	Azerbaidzhan
UF6, UK6F, O, Q, V	Georgia
UG6, UK6G	Armenia
UH8, UK8H	Turkoman
UI8, UK8I	Uzbek
UJ8, UK8J, R	Tadzhik
UL7, UK7	Kazakh
UM8, UK8M, N	Kirghiz
VS6	Hong Kong
VS9K	Kamaran Is.
VU	India
VU7	Andaman & Nicobar
VU7	Laccadives
XU	Khmer Republic
XV	Vietnam
XW	Laos People's Dem. Rep.
XZ	Burma
YA	Afghanistan
YI	Iraq
YK	Syria
1S	Spratly
4S	Sri Lanka
4W	Yemen
4X, 4Z	Israel
5B4, ZC	Cyprus
7O	People's Dem. Rep. of Yemen
8Z4	Neutral Zone Saudi Arabia/Iraq
9H	Malta
9H4	Gozo & Comino
9K	Kuwait
9M2	West Malaysia
9M8	North Borneo
9M8	Sarawak
9N	Nepal
9V	Singapore
	Abu Ali, Jabal Attair

OCEANIA

A3	Tonga Republic
CR8	Portuguese Timor
C2	Republic of Nauru
DU	Philippines
FK	New Caledonia
FO	French Polynesia
FW	Wallis & Fortuna Islands
H4, VR4	Solomon Islands
JD, KA1	Minami Torishima
JD, 7J1	Okino Torishima
KB, KH1	Baker, Howland, American Phoenix
KC6	Eastern Carolines
KC6	Western Carolines
KG6, KH2	Guam Island
KG6R	Rota
KG6S	Saipan
KG6T	Tinian
KH6	Hawaiian Islands
KH7	Kure Island
KJ, KH3	Johnston Island
KM, KH4	Midway Island
KP6, KH5K	Kingman Reef
KP6, KH5	Palmyra
KS6, KH8	American Samoa
KW, KH9	Wake Island
KX	Marshall Islands
P2	Papua, New Guinea
T2, VR8	Tuvalu Island
VK	Australia
VK	Lord Howe Island
VK9	Willis Island
VK9	Christmas Island
VK9	Keeling, Cocos Island
VK9	Mellish Reef
VK9	Norfolk Island
VK9	Macquarie Island
VR1	British Phoenix Islands
VR1	Gilbert Island
VR1	Ocean Island
VR3	Christmas Island
VR6	Pitcairn Island
VR7	Line Island, South and Central
VR8	(See T2)
VS5	Brunei
YB, YC, YD	Borneo
YB, YC, YD	Celebes
YB, YC, YD	Java
YB, YC, YD	Sumatra
YB, YC, YD	West Irian
YJ	New Hebrides
ZK1	North Cook Island
ZK1	South Cook Island
ZK2	Niue Island
ZL	New Zealand
ZL	Auckland & Campbell
ZL	Chatham Island
ZL	Kermadec
ZM7	Tokelaus
3D2	Fiji Islands
5W	Western Samoa

AFRICA

A2	Botswana
C5	Gambia
C9	Mozambique
CN	Morocco
CN2	Tangier
CR3	Guinea Bissau
CT3	Madeira Is.
D2, 3	Angola
D4	Republic of Cape Verde
D6	Comoros
EA8	Canary Islands
EA9	Ceuta and Melilla
EA9	Ifni
EA9	Rio de Oro
EL	Liberia
ET2	Eritrea
ET3	Ethiopia
FB8W	Crozet
FB8X	Kerguelen Is.
FB8Z	Amsterdam & St. Paul
FH	Mayotte
FR	Glorioso Island
FR	Juan de Nova, Europa
FR	Reunion
FR	Tromelin
H5	Bophuthatswana
IG	Lampedusa Island
IH	Pantelleria Island
J2, FL8	Djibouti
S7	Seychelles
S8	Transkei
S9	Sao Tome and Principe
ST	Sudan
ST0	South Sudan
SU	Egypt
TJ	Cameroon
TL	Central African Empire
TN	Congo
TR	Gabon
TT	Chad
TU	Ivory Coast
TY	Benin
TZ	Mali
VK0	Heard Island
VQ9	Aldabra Island
VQ9	Chagos (Diego Garcia)
VQ9	Desroches
VQ9	Farquhar
XT	Upper Volta
ZD7	St. Helena
ZD8	Ascension Island
ZD9	Gough Island and Tristan da Cunha
ZE	Rhodesia
ZS1, 2, 4, 6	South Africa
ZS2	Prince Edward Island
ZS2	Marion Island
ZS3	Southwest Africa (Namibia)
3B6, 7	Agalega & St. Brandon
3B8	Mauritius
3B9	Rodriguez Island
3C	Equatorial Guinea
3D6	Swaziland
3V	Tunisia
3X	Republic of Guinea
3Y	Bouvet Island
5A	Libya
5H	Tanzania
5N	Nigeria
5R	Malagasy Republic
5T	Mauritania
5U	Niger
5V	Togo
5X	Uganda
5Z	Kenya
6O	Somali
6W	Senegal
7P	Lesotho
7Q	Malawi
7X	Algeria
8Q, VS9	Maldive Islands
9G	Ghana
9J	Zambia
9L	Sierra Leone
9Q	Republic of Zaire
9U	Burundi
9X	Rwanda

not retain your paperwork once the request for issuance is mailed.)

We hope you enjoy the challenges of the *73* Awards Program and will share its rules with your amateur friends. While we hope you all will pursue the objectives these awards have to offer, we also hope you will send any information you might have on other award programs which have never appeared between the covers of this magazine. Looking through my files, I see where we have gone many many months without duplicating information on a single award. Our files are getting bare, however, and it is the input of readers that keeps the image of this column original and creative. If your club has an award it sponsors, why not share it with our thousands of readers?

JERSEY DEVIL STATION W2JUG TO OPERATE HALLOWEEN

The West Jersey Radio Amateurs (WJRA) will man a special operation from the South Jersey Pine Barrens, the haunt of the feared Jersey Devil. Beginning and ending at midnight, the courageous WJRA group will attempt to operate the entire 24 hours of Halloween, October 31st. A certificate engraved with a countenance of the Jersey Devil will be sent to all stations worked who send an SASE to WJRA, PO Box 62, Burlington NJ 08016. Frequencies to be used are 15 kHz from the bottom of each General phone band, 80 through 2 meters. Novice operation also will be 15 kHz up.

The Jersey Devil was born in 1735, a 13th child, in a place called Leeds Point. Not long after its birth, on a foggy and dreary night so usual in the Pine Barrens, the child assumed a serpent-like body, cloven hoofs, the head of a horse, wings of a bat, and the forked tail of a dragon. With loud, raucous cries, it flew up the chimney and into the heart of the Pinelands. Appearances and sightings occur even today. On Halloween, the WJRA will maintain a radio vigil, trying to capture a glimpse of the Devil. Will they see him? Give them a call (W2JUG) and get a first-hand report. (Oh, yes. If the answer is a loud, raucous, cry...) If you have any questions, call (609)-386-5906 or write Frank Huminski K2SQS, 307 Monroe Street, Edgewater Park NJ 08010.

CEDAR ISLAND DXPEDITION

The McHenry County Wireless Association announces a DXpedition to Cedar Island for September 19 and 20, 1981. No ham radio activity has ever taken place from this island in Pistakee Lake, McHenry County, Illinois. The call used will be KB9I, with expected frequencies of 21365 and/or 7265.

WARWICK RI 50th

On September 12th and 13th, the Warwick Amateur Radio operators are sponsoring a special event. The City Of Warwick, Rhode Island, will be celebrating its 50th anniversary. To commemorate this event, any amateur contacting a participating Warwick amateur will be awarded a certificate signed by the mayor of the city. QSL information: mail with three first-class stamps to Pat Mancini K1COI, 11 Amherst Dr., Warwick RI 02889.

GMT times: 1300Z to 2200Z September 12 and 13. Frequencies: Phone—28750, 21380, 14300, 7275,and 3950; Novice—21175, and 7125; CW—28075, 21075, 14075, 7075, and 3575. For further information, contact Robert A. Weigner KB1C, 61 Kirby Ave., Warwick RI 02889, (401)-738-2021.

OMAR BRADLEY

The Tri-County ARC of north-central Missouri is planning a special-events station from Clark, Missouri, birthplace of the late five-star General, Omar N. Bradley, from 10 am to 6 pm on Labor Day, September 7, 1981. Anyone contacting the special-events station will receive a commemorative certificate honoring General Bradley. Operation will be in the general portion of 40, 20, and 15 meters. Send QSL with SASE to Tri-County ARC, 601 McKinley, Moberly MO 65270

RR SESQUICENTENNIAL

The Schenectady Amateur Radio Association will operate a special-event station, K2AE, to commemorate the sesquicentennial (150th) anniversary of the opening of the Mohawk & Hudson Railroad. The railroad was the first to operate in New York State, the first to operate north of the Mason-Dixon line, and the third to run in the United States. Listen for K2AE the weekend of September 26 from 1600Z Saturday to 1700Z Sunday on the following frequencies plus or minus QRM: 7235, 14285, and 21360. Amateurs who work K2AE and desire a QSL card showing a likeness of the historic train should send an SASE to K2AE.

FORD MUSEUM

America's newest Presidential museum, the Gerald R. Ford Museum, will be dedicated this September in Grand Rapids, Michigan, during a week-long celebration that also will call attention to the multimillion dollar revitalization of the city's downtown area.

To commemorate the event, the Woodland Amateur Radio Club is planning to establish a radio station at one of the main locations of the celebration, operating under the callsign of W8FM. Amateur operators who contact W8FM during the celebration will receive a certificate with the official Ford Museum Dedication seal and Gerald R. Ford's signature. Operations will be on September 17 and 18 from 1600 to 0000 UTC. On September 19, the station will operate from 1300 to 0100 UTC. Plans call for operation on frequencies on or near 28.650, 21.410, and 14.310 MHz.

To receive one of these certificates, send a QSL card to W8FM, Post Office Box 6102, Station C, Grand Rapids MI 49506. Do not send IRCs or self-addressed envelopes.

K2BSA

Those who worked K2BSA/4 from the 1981 National Scout Jamboree and wish a special commemorative QSL should QSL with a business-sized SASE to K2BSA/4 Jamboree, c/o ARRL, 225 Main St., Newington, CT 06111.

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

CB RADIO

Citizens Band and amateur radio have had a curious relationship over the years. Like two rival siblings, they vie with each other for Daddy FCC's affection.

Amateurs are like the brother who went to college. Hams are worldly, cultivated—with all the latest conveniences at their disposal. CBers, however, have the tough life. They've garnered the reputation of the black-sheep brother who hangs around the local bar, caging drinks from fellow barflies.

A CBer is opinionated and crass—rough on the ears—but never pretending to be something he isn't. There's no mistaking where he's from. He's a dope, and you know it. Hams, on the other hand, put on airs. Many are educated dopes, but they try to cover it.

Actually, it's not a case of who is better. Hams and CBers are dif-

ferent, the use of radios being our only family tie. There's been a long-felt animosity between members of the two camps, but when you consider that many hams are CBers (and in some cases vice versa), it's a peculiar enmity. As we said, it's like a sibling rivalry.

Acknowledging our "brotherly" relationship, this month's FUN! salutes CB.

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1) CB frequency slots
5) Good CW can be a work of this
8) Never satisfied DXer wants...
11) What the ARRL does to CBers
12) Plenty of this on CB channels
13) Never say this
14) A logic (abbr.)
16) One who spends $5,000 on CB gear
17) CBer's personal "ball"
18) California city (abbr.)
19) Data transmission (abbr.)
20) New GMT (abbr.)
22) Soggy reaction of dealers stuck with 23-channel rigs
23) What we all call the FCC monitor
24) Symbol: aluminum
25) _____ and feather jammers (abbr.)
27) Old amateur industry group (abbr.)
29) What this is all about (abbr.)
31) Sidewinder's mode (abbr.)
32) FCC never has to say this
33) Atomic (abbr.)
34) Popular rig prefix
35) CBer's signal verification (2 words)

Down

1) CB cretins
2) Old Advanced hams
3) FCC _____ pressure on all
4) Mentioned
6) Original number of CB channels
7) Lids
9) Fellow ham (abbr.)
10) Decay
15) Below MF (abbr.)
19) Affectionate DX ham expression (abbr.)
21) "Regular" CB
22) R/C CB
24) Most popular CB mode (abbr.)
26) Light beam
28) Radio bearing (abbr.)
29) Usual CB mobile
30) Morse double-dash
34) Time-out (abbr.)

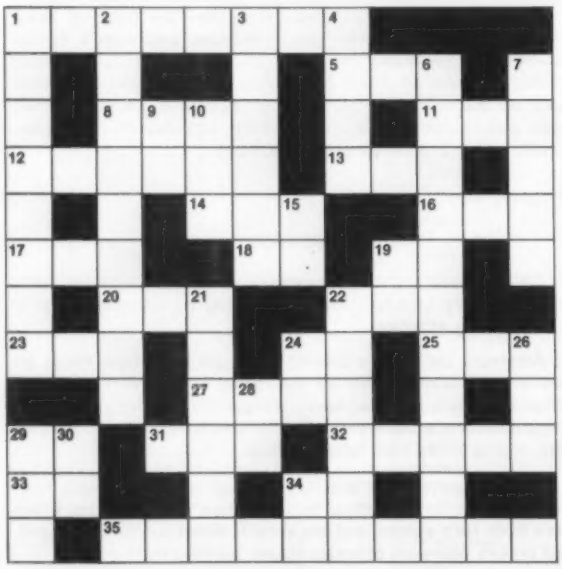


Illustration 1.

ELEMENT 2—MULTIPLE CHOICE

1) How many CBers were active in 1959?
1) 3,000
2) 6,000
3) 50,000
4) 250,000

2) What famous World War II tank commander used 11 meters to coordinate his maneuvers?
1) Patton
2) Rommel
3) Montgomery
4) Swirsky

3) What FCC commissioner first proposed the idea of CB radio in a *Saturday Evening Post* article entitled, "Phone Me By the Air"?
1) Herbert Hoover
2) Charles Ferris
3) E. K. Jett
4) Arnold Jackson

4) In an incredible plan designed to ruin CB, in 1969 the FCC decided to raise CB license fees from $8 to a ridiculously high level. How much did the "new" CB ticket cost?
1) $10
2) $15
3) $20
4) $50

5) In 1948, the FCC authorized the Firestone Tire and Rubber Company to conduct the first commercial tests using small, three-Watt transceivers on what is now channel 23. What was the first CB callsign issued by the FCC to Firestone?
1) KBX-8669
2) KAA-0001
3) W10XXD
4) W2XR

ELEMENT 3—MATCHING

Remember CB slang? Sure you do, and if you have an IQ larger than your hat size, you hated it. Nevertheless, the media loved it, and for about 12 minutes this "language" was worked into all types of movies, TV shows, and country music records.

Now, CB slang has been dumped into that great nostalgia warehouse up in the sky, up there with Davy Crockett hats, hula-hoops, and disco leisure suits. But FUN! never forgets. So slip your brain into neutral for a moment and try to match the CB slang listed below with its correct meaning.

Column A	*Column B*
1) Smokey	A) Small car
2) Invitation	B) Slippery road
3) Cotton picker	C) Motel
4) Tijuana taxi	D) Police ticket
5) Bottle popper	E) FCC license
6) Rollerskate	F) Highway cloverleaf
7) Twister	G) Police officer
8) Nap trap	H) Beer truck
9) Skating rink	I) Reckless driver
10) Harvey Wallbanger	J) Police car
	K) An expletive

ELEMENT 4—FILL IN THE BLANK

1) CB rules and regulations are detailed in FCC Part _____.
2) The frequency tolerance for a CB transmitter is _____%.
3) Up until about 10 years ago, units of the same station could use all 23 channels, but station-to-station contacts could only take place on ____ different channels.
4) _____ was the organizer of the "Save 11" campaign.
5) Application for a CB license is made on FCC Form _____.
6) CB beams are _____ polarized.
7) A full-length CB mobile antenna is _____ inches long.
8) _____ Watts PEP is the maximum SSB CB power.

9) Ham radio _____ still occupy 11 meters in Australia.
10) The Radio Emergency Associated Citizens Team is better known as _____.

ELEMENT 5—HAM ACROSTIC

Guess the words defined and write them over the numbered dashes. Next, place each letter in the correct square in the puzzle. The black squares show word endings. The completed puzzle will form a statement relating to this month's topic.

(Illustration 2)

A) CBer's "code"..... 30 52 41
B) 27.605 MHz..... 15 8 39 3
C) Disgust..... 7 48 18
D) Class of commercial license needed to repair CBs..... 29 34 5 31 38 17
E) Present number of channels..... 47 12 28 56 51
F) Slang for transceiver..... 9 40 54
G) 10-90..... 11 21 37
H) "CBers" above channel 40..... 2 49 27 35 10
I) "Highway Emergency Locating Plan"..... 55 44 19 13
J) Band for converted CBs..... 1 42 46
K) Broadcast network..... 32 33 36
L) Designs rigs..... 25 45
M) Tower anchor material..... 6 16 24 14 23 43
N) Transistor type..... 4 20 26
O) Cable bundle joiner..... 50 53 22

FUN! MAILBOX

I've been in radio since 1963 using CW, AM, FM, and RTTY—all in the military. I finally came into ham radio as my interests are all leaning that way. I suspect you lean too far towards the Green way of thinking. Why? Employer-employee relationship? Ego? We have too many inflated egos on the air also. The above is my opinion and I also respect yours. Tnx. P.S. How long you been a member of the ARRL? You seem to have lots to say about that, too. I think your April column stank—cheap shot. Why?

Robert E. Cregar WD8NKT
Bay City MI

I've been a League member since the first year I became a ham, and I'm too poor to afford expensive shots.—JE

C	H	A	N	N	E	L	S	■	■	■	■	■
H	■	A	■	■	X	■	A	R	T	■	L	■
U	■	M	O	R	E	■	I	■	W	O	O	■
C	L	A	M	O	R	■	D	I	E	■	U	■
K	■	T	■	T	T	L	■	■	N	U	T	■
E	Y	E	■	■	S	F	■	D	T	■	S	■
R	■	U	T	C	■	■	C	R	Y	■	■	■
S	I	R	■	L	■	A	L	■	T	A	R	■
■	■	S	■	A	R	M	A	■	H	■	A	■
C	B	■	S	S	B	■	S	O	R	R	Y	■
A	T	■	■	S	■	T	S	■	E	■	■	■
R	■	R	A	D	I	O	C	H	E	C	K	■

Illustration 1A.

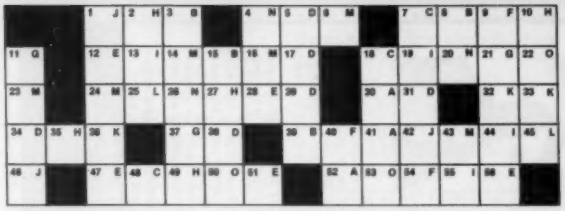


Illustration 2.

THE ANSWERS

Element 1:
See illustration 1A.

Element 2:
1-2 Vacant territory.
2-2 During World War II, a Rhode Island amateur heard some strange transmissions on what is now channel 14. After contacting the FCC, it was determined that the transmissions were coming from Field Marshal Erwin Rommel commanding his Afrika Korps. The information was passed to British and U.S. forces and later played a significant role in Rommel's defeat. Thus, Rommel may have been the first man snagged by the FCC for working skip.
3-3 It sounded like a great idea in July, 1945. But, then, America had just won a world war; who could have predicted that the FCC wouldn't be able to regulate a bunch of low-powered radios?
4-3 If you make licenses expensive, people won't get them; hence, no CBers. With logic like that...
5-3 The first of many.

Element 3:
1—G, 2—D, 3—K, 4—J, 5—H, 6—A, 7—F, 8—C, 9—B, 10—I.

Element 4:
1—95, 2—.005, 3—7, 4—Wayne Green, 5—505, 6—vertically, 7—108 including spring, 102 without, 8—12, 9—does, 10—REACT.

Element 5:
See illustration 2A.

SCORING

Element 1:
Twenty points for the complete puzzle, or 1/2 point for each question correctly answered.

Element 2:
Four points for each correct answer.

Element 3:
Each slang word correctly matched nets you two points.

Element 4:
Two points for each blank filled.

Element 5:
Two points for each correct answer. Give yourself 20 extra points if you unscrambled the message.

Rate yourself:

1-20 points—No buddy
21-40 points—Poor buddy
41-60 points—Fair buddy
61-80 points—Good buddy
81-100+ points—Great buddy

■	■	T	H	E	■	F	C	C	■	F	I	R	S
T	■	O	P	E	N	E	D	■	E	L	E	V	E
N	■	M	E	T	E	R	S	■	T	O	■	C	B
E	R	S	■	I	N	■	N	I	N	E	T	E	E
N	■	F	I	F	T	Y	■	E	I	G	H	T	■

Illustration 2A.

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'73 Bill Salerno

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VISA MasterCard

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↙300

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2"
.19"
Rear View of P-3
PATENTED
P-3 12 KEY 2"
P-3 16 KEY 2.5"
P-3 16 KEY SLIMLINE 2.4"
* AT&T

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TO OBTAIN THE NEXT UNSERVICED BARGAIN LIST SEND A SELF ADDRESSED STAMPED ENVELOPE.

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

they were not speeding, but were victims of interference to the police radar unit.

My first response is to suggest that perhaps it is about time to invest in a radar detector so that in the future they will know when a police radar unit is in the area and stop transmitting until safely out of radar range. The modern superheterodyne models will give you more than adequate warning to get off the air. I'm using both the Escort from Cincinnati Microwave and the Whistler Q-1000 with success. I've been promised test models from other firms, so I may be able to add to that list. The $245 for the Escort is cheap enough insurance when you consider the trauma of the ticket and court appearance. Further, beating a ticket is tough, even when you are completely innocent, so you have insurance increases to look forward to as well.

If you are interested in fighting a ticket, you might want to contact Electrolert, the makers of the Fuzzbuster. They sell legal kits which will help both you and your lawyer through the situation. Fuzzbuster, incidentally, at long last has a superhet receiver available...though I have not yet tested it. Electrolert, 4949 South 25A, Troy OH 45373. Phone (513)-667-2461.

A recent release from Electrolert explained about a franchise of legal firms called The Ticket Clinic. This started in Lubbock, Texas, and is spreading around the country. For $45 you can have your ticket defended by experts...with an 80% success rate. This is a great development.

Cincinnati Microwave was started by some hams who had worked at Drake. I like their unit because i've found none that works better...at any price... and it has an S-meter, which tells me just how close the radar really is. This also helps separate the 10-GHz security systems from the police radar units, once you get the hang of it. These can be a nuisance, but they are also comforting in that you get used to their locations and they let you know your detector is working right. Cincinnati can be reached at (513)-772-3700. They sell direct only, not through stores. Tell 'em Wayne sent you. They know me. As a ham and *73* reader, you might just get a receiver which is extra hot.

DXCC PROBLEMS

The massive forging of QSL cards for DXCC, an industry located, naturally, in California (the land of entrepreneurs) gives us a lot of possibilities. My first reaction (knee-jerk) was that a group of amateurs had done a terrible thing. Imagine! Desecrating one of our most treasured idols, the DX Century Club, with a cheap plot to debase its virtue! Tsk.

But then the iconoclast in me began to emerge and I got to thinking about the other side of the coin. DXCC and the accompanying Honor Roll listings have brought about the building of a cult of several hundred hams who have, as a result, devoted their lives to working every country in the world. This, in turn, has made life absolutely miserable for new hams in rare spots, often driving them off the air in hours...permanently.

Though I've never felt the need for public recognition as a super DXer and thus have not ...at least in recent years... messed with the ARRL and their amusing award record-keeping system, I have enjoyed tackling the goal of working a lot of countries. After I moved to New Hampshire and discovered that I would have to start all over again...yoiks, my XU cards were no longer valid!...I went at it with relish. In the first week on the air, I passed the 100-country mark on 20m phone (my favorite). By the end of the first month, I had passed 200 countries, and I arrived at 300 before the end of the year. I stopped counting then.

I remember spending a whole weekend working 100 countries on 20m...just to prove that it could be done. Now I admit that not all of the contacts were meaningful (it was during a contest) but I managed it...and got the cards to prove it.

A few years ago, fed up with some of the ridiculous rules set up for DXCC credits, I started an award...Worked the World. This one used country lists from national ham organizations instead of from our own internal committee. Thus, if RSGB recognized an island as a country...it *was* a country by us. Ditto the DARC and all other recognized national groups. This went well until we began to notice some strange DX cards appearing in the bundles from a Texas ham. Hmm. Some of the cards were from rare stations I'd worked and they were *not* the regular cards. We looked into it and found that our Texan was working with a printer to make up special cards...all for our award. Sigh.

Okay, here's my idea. Since *73* has one of the largest QSL printeries in the country, why not come up with a series of special DX cards...one for each country of the world. Then, for a modest price, we could arrange to have these mailed to a DXer from each of those countries, all filled out with his call and a great signal report. We have subscribers in over 200 countries now, so we should be able to make arrangements from most countries. The rare ones would be more expensive because we would have to send someone out a couple times a year to make the mailings. Hey, how about *me* for that job...I love to travel. The cost of the cards would pay for the trip, just as it did for Don Miller. In fact, he bragged to several people that he was clearing over $50,000 a year...and that was back when $50,000 was worth a whole lot more than it is today.

Carpers who beef about the cards not being honest should face some brutal facts. Quite a lot of the cards I have...all acceptable for DXCC...are not honest. We don't really know where Miller was for many of his DXpeditions...we only know he wasn't anywhere near where he said he was. The cards are all okay by the ARRL...even my Spratley and Burma cards. I love it.

We can't seriously come down on Miller in this situation because he was just following in the footsteps of even more famous DXers, all of whom had left a trail of DX operations from places other than they claimed. I personally have had cards from at least 30 countries which are fraudulent, but they are acceptable to the DXCC team. No, I don't put a lot of stock in awards...or cards. As soon as you start an award, people will get right to work to cheat on it...so why not make the cheating part of the business and help people enjoy their cheating? That, obviously, is also a part of amateur radio...just like jamming.

I figure that a 100-country package of cards might go for $250. Cheap enough when you consider the saving in postage stamps, reply coupons, and aggravation. The 300-country package will have to cost a bit more...perhaps $1,000. After all, you don't want to have me stay in a cheap hotel in Rarotonga, do you? The biggo, #1 on the Honor Roll, means getting into places like Iraq to mail cards, so we'll have to research that one more. Would $3,000 be reasonable?

Specialized awards such as all on SSTV or RTTY would only cost a little extra...just enough to keep away the browsers and keep the award clean...just for the more serious hams. We could have a One-Watt Special Award for 100 countries with only one Watt of power input...or should it be output? Mobile fans could have their own special awards. If you can pay, you can play...and have one of the most impressive ham shacks in town. Remember that the neighbors and family won't know any better...and the ARRL doesn't care. Our cards would all be legitimate, sent direct from the actual country...complete with postage stamp. The only thing lacking would be the contact.

Now of what real importance is a contact? You know as well as I that a DX station anywhere in the world can be worked if you hang in there. It's a matter of spending the time. If you want to be one of the first with the contact...thus giving you time to jam the hell out of the DX station

later to keep others from making the contact...you need high power and a good beam system. No, you can eventually make it even with low power, if the DX station stays on the air long enough. W2QHH proved that years ago with his massive awards collection...all worked with around 100 Watts. Howie is still listed in the *Callbook*, so I assume he is working on certificate number 8,000 by now.

We may just have something here. With this system of getting awards, we might encourage amateurs in rare countries to get on the air and make normal ham contacts instead of contest-type operation every time they appear. Further, we might eventually get rid of pileups. Suppose DX stations stopped QSLing direct, leaving that to us professionals? It would be much more efficient and would save them a fortune. No more "green QSLs" (five dollar bills), no more wasting days filling out cards just because a DX op wanted to get on the air for a few hours of fun. It has benefits for everyone.

There's no reason to just cover DXCC when there are many more awards to be achieved... WAC for $10, right? WAS for $50...an October special. WAE might run $100 since that is harder. WAZ won't be any less, calling for me to get up to Ulan Bator a couple times a year. Maybe $200 would be right for that one.

You all set?

NIAC TESTIMONY

In the July issue, I discussed briefly the National Industry Advisory Committee (NIAC) which has been set up to advise the FCC on amateur matters, with particular emphasis on emergency communications. I think you may be interested in part of my testimony before that committee, so I'll reprint it here verbatim.

With the change in administrations there may be an opportunity for NIAC to provide a valuable service to the amateur radio community, to the FCC, and perhaps in the long run, to our country. We amateurs have arrived at our present situation via a long and complex route, so I can't offer suggestions on ways to bring about what I feel are needed changes without laying the groundwork by tracing some of the events which brought us to where we are.

It does not take any keen perception to see that amateur radio is stagnant. Our growth is minimal. It has been over 10 years since the last major technology change: repeaters, FM. Our clubs are falling apart. Our manufacturers are failing, as are our ham dealers. Virtually all the technological advances in amateur equipment have been coming from Japan, such as synthesized transceivers and synthesized hand transceivers.

Speaking of technology, it is not only amateur equipment in which the Japanese are leading us. If you are familiar with virtually any other branch of electronics, you will find a similar situation. The innovative calculators, which I hear ringing around us, are all coming from Japan. Ditto the cassette and stereo equipment. I am sorry to say, though the U.S. originated the microcomputer industry *only* five years ago, Japan is already ahead of us in the design of these low-cost computers.

In many electronic fields, as I read the technical journals, I find that the U.S. is now having to import technology from Japan. There have been several articles on this subject, on the loss of our technical eminence, and they all bring up the lack of growth of engineers in our country over the last 20 years. With zero growth in engineers and presumably technicians since they go hand in hand, while there has been a virtual explosion of engineers and technicians in Japan, it is little wonder that there has been a shift in the frontiers of technology in electronics.

If we look back on our own history to see what conditions brought about our present situation, we see one event emerging very clearly.

During the late 1940s, after the war, and through the 1950s, amateur radio was growing at a steady rate of 11 percent a year. This was brought to a sudden halt in 1963 by two events, both of which involved the FCC. One was the four-dollar license fee, which I view primarily as an event which tended to weed out the inactive hams who had been keeping their licenses because they cost nothing. The second and far more catastrophic event was the so-called incentive licensing proposal. If the license fees had been the main culprit, we would have seen a temporary drop in licensees as the inactive hams dropped out. But our input of new hams would have remained constant, and we would soon have been back into a growth mode.

The fact is that it took 11 years before we again saw growth. Having been involved with the licensing proposal, I can testify as to the depths of the emotions it stirred. The prospect of losing virtually all phone privileges dismayed the 90 percent of the hams so threatened. And the prospects of having to go through to an Extra class license before much in the way of DX phone bands would be available turned away hundreds of thousands of prospective hams.

The eventual rules which took away only half of the phone bands instead of all of them did not help matters a lot. This denied the contacting of DX stations to a very high percentage of the hams and denied them experimenting with slow-scan television.

It was this rulemaking situation which I feel was largely responsible for amateur radio stagnating for 11 years. Since that time, we have managed to get back into a growth mode, but only a slow one.

The surveys of amateurs which I have taken via my publication show clearly that the main body of newcomers to amateur radio are teenagers. Indeed, ARRL studies have shown this same fact, with one such survey showing that 50 percent of the newly-licensed amateurs are either 14 or 15 years old. Further surveys show that over 80 percent of these teenagers then go on to develop careers in electronics or communications.

In my talks with R&D firms, there is no question but that the radio amateur who has pursued an electronics career is usually far more valuable when it comes to inventive technology than his non-ham counterpart. The ham is often almost totally immersed in electronics, reading about it at every opportunity and talking about it at work and over the air with friends. He usually has his own lab at home, as well as his ham shack.

If we then project the growth we could have expected from amateur radio, had it not been brought to a halt in 1963, we find that we might have had about one and three-quarter million licensed hams today. That would have resulted in there being at least one million more engineers and technicians than we have today, and that is quite a lot.

Remember, too, that at the same time we were stopping ham growth, the Japanese instituted their no-code license. Further, they actively recruited hams in high schools through clubs. These clubs engage in expeditions, field-day outings, mountaintop VHF trips, hidden transmitter hunts, and so on. Even a casual glance at the Japanese ham magazines will show you that there are hundreds of pictures monthly of these club activities.

The latest issue of *CQ Ham Radio*, the Japanese magazine, had 46 pages of pictures of clubs doing things. So while amateur radio was crumbling in the U.S., the Japanese went from a few thousand hams to over 500,000, with virtually all of them active. Yes, Japan has about half again as many licensed hams as we do, and perhaps three times as many active ones.

I believe that this is where their technological superiority has its foundation. Well, no matter what the case, there is no denying that amateur radio in the U.S. is growing very slowly. I believe that if we could get amateur radio growing again, we might eventually be able to regain the technological superiority we had a few years ago. Most of the loss has occurred in the last five years, as the Japanese caught up and passed us in technical people.

By the way, in case there are any questions about the ability of amateur radio to accommodate two million U.S. hams, I think we could. And it would be a blessing in many ways. There are so many possible ways for us to cope with vastly more active hams, with new technologies, that I wish we had that pressure to get us going with some of them.

Now if we are going to meet the challenge, we need to do every thing we can to get amateur radio into a very strong growth mode. This means we should take a close look at our regulations and see what might be changed with them which might help in our growth. We might look to our clubs as a resource in promoting growth. Perhaps a new technology would help. It would spark interest and growth. The emergence of FM and repeaters ten years ago was the catalyst which got amateur radio moving for a while. The interest of this new mode, together with a supply of pre-interested people from CB, gave us a spurt of growth in the mid-seventies. The FCC's CB 40-channel disaster, which virtually killed Citizens Band, cut off our supply of enthusiasts from that source. It may be time to seriously consider some sort of no-code license.

I have heard every argument pro and con on code. Indeed, it has been perhaps 20 years since I have heard anything new on this. Just the same old arguments. Taking all of this into consideration, we may want to come up with a different approach to licensing, one which will remove the skill aspect of the code test and substitute operating knowledge, as the Japanese have done. There is much that we can learn from the Japanese system, which is working quite well.

And I might just say that any of you who have worked with Japanese amateurs know that you will not find any finer operators in the world.

If we are going to be able to get our older amateurs enthusiastic again, I think we will need some sort of technological development. It is most unfortunate that the FCC for many years made such developments virtually impossible.

As an enthusiast in radioteleype in the late forties, I found it exceedingly difficult to pursue the need for technical developments because the FCC stopped me at every turn. When we wanted to experiment with radioteletype on the low bands, we found that the FCC would not permit it because their monitoring stations were not yet equipped with teletype equipment.

Since it takes years before these monitors finally get new equipment, this approach to our rules meant that amateur experimenting and development would always have to lag commercial developments by 10 to 20 years. And that was the way it was through the fifties and to date. We are still forbidden from unrestricted experimenting because the FCC won't let us use a mode until they can monitor it. One of the first rules that the FCC has on its books for amateur radio, Part 97.1c, is aimed at the Commission, not at amateurs. It is a rule that the Commission must encourage and improve the Amateur Service "through rules which provide for advancing skills in both the communication and technical phases of the art."

The Commission has not been responsive to that, the only amateur regulation guiding them in their job. The FCC rules should be either made or interpreted so that amateurs are not just permitted, but encouraged, to experiment and pioneer new ideas. With the development of large-scale integration and digital electronics, the horizon for the development of new techniques and modes of communication are almost limitless.

We should remember that it was amateurs who historically invented most of the communication modes which are in common use today. It was the development of practical sideband circuits by Don Noregaard in the forties which made sideband possible for military, commercial, and amateur uses. It was the pioneering of amateurs which brought FM mobile uses, and then in 1946 narrowband FM. Slow scan was developed by amateurs, as were parametric amplifiers, helical antennas, and so on. Much of the early television experimentation was done by amateur radio, with the early industry people coming from one particular ham project in Astoria, New York.

Amateurs could, with encouragement from the FCC, be experimenting with many digital techniques. We have plans for setting up dictionaries on IC chips, which would enable us to communicate via ASCII, but at 5,000 words or more a minute with instant translation into any language in the world. Immediately any ham in the world would be able to converse with any other with few translation problems. A two-byte message sent at 1200 baud would give us the possibility of 32,000 words. A one-byte message would give us the use of 256 most-used words, which represents about 75% of the normal messages. 1200 baud is narrow enough so it is practical over ordinary phone circuits, so it should not be difficult to accommodate on the ham bands.

The words would be typed into a small microcomputer. This would look up each word in the dictionary and store the appropriate byte or two bytes of information for each word. When the message is ready to go, it would be sent in a second or two, thus leaving the radio spectrum available

for hundreds of similar contacts on the same channel without interference.

When received, the bytes would be looked up in the dictionary on the other end, which could be in any language. The resultant message would then be displayed on the microcomputer at that end.

What about voice? As computer circuits and ICs improve, we are getting better and better at translating voice into digital information and then back again. We even have reasonably well-sounding talking clocks which fit into a shirt pocket, with a voice entirely synthesized and digitalized. The work is done by a single silicon chip.

We need rules encouraging experiments with these techniques. We have plenty more in prospect. Spread-spectrum communications have enormous possibilities. Double-sideband stereo transmission should be investigated as a possible method of increasing our density of spectrum use by a factor of 100 or more.

Digital audio without synthesizers may have possibilities for compression and expansion for the time-slicing techniques where we could have half a dozen or more contacts taking place on one channel with no interference between stations. We might even be able to get back to full duplex operation with all on one channel with time-slicing. That could bring about enormous changes in amateur radio communications.

With the space shuttle coming soon, we may be able to put up a great many more amateur satellites or even get spectrum for ham use on some of the commercial satellites.

With this resource, we could set up emergency communications, an emergency communication network, far beyond anything ever imagined before.

With our repeaters able to interconnect via satellite relay, handie-talkie to handie-talkie contact anywhere in the world is a possibility. Indeed, commercial services are going to be working hard on satellite uses, with the possibility of phone and digital communications between cars or even people on foot very likely.

As each of these possibilities is opened up, they in turn bring us new ideas which can be tackled with the use of VLSI circuits. In many ways we are presently just at the beginnings of amateur radio development if the FCC can be persuaded to encourage amateur experimentation. If there is any question about this being a problem, just ask the Commission how many hundreds of applications for Special Temporary Authority for experimenting with ASCII were turned down in the last few years. This was not a small problem. It was one of major proportions. At a time when our technical journals are citing more and more cases where we are importing electronic technology from Japan, it may be time for us to seriously consider tackling the problem in as many ways as we can. There is much that NIAC can do to help spur the growth of amateur radio.

It could be working with the Commission to try to work out approaches to free amateurs for experimentation and study possible changes in the rules which might encourage the substantially greater growth which is needed. Indeed, is there a better group than NIAC for tackling this important problem?

And I might ask that those of you who are going to discuss the new rules notice that one major change has not been made, and that is in the emission mode allocation. They tell you what is permitted, and therefore anything else is not permitted. And it should be the other way around.

The general interpretation of the amateur rule is that if it is not specifically prohibited, it is permitted. And that is the type of freedom that we need. I hope we will remember that when we discuss these rules.

I thank you all very much for your time.

Though the proposed new plain language rules do not include the providing of service in emergencies as a goal of amateur radio, I think we should keep that purpose in mind and always work in the direction of being able to provide emergency help.

In line with this, the better our amateur radio communications systems, the more help we will be able to provide in emergencies. There is nothing so useless as an emergency system which is for use only during emergencies. The equipment won't work...and the operators will be unfamiliar with it and with procedures. If we are going to be able to provide truly valuable emergency communications, we need to have the system up and running on a daily basis. In that way, we encourage the investment in time and equipment which is needed. Who wants to buy a bunch of gear which they can't use until an emergency? Or do we expect the government to buy it for us?

Last year the worst hurricane in over a hundred years hit the tiny island of St. Lucia in the Caribbean. All telephones and commercial communications were demolished. Planes couldn't even land at the airports because they had no radio to talk them down.

I recently visited St. Lucia and talked with the hams there... and with the Prime Minister. From every side I heard nothing but lavish praise for the way the amateurs stepped in and got things running again. *73* sent down Tim Daniel N8RK with four trunks full of ham gear and commercial HTs. The HTs were immediately used to reestablish the airport-to-plane communications. The ham gear, along with that of the local amateurs, provided about the only dependable communications the government had with its people for a week or so. Tim worked hard and did wonders, but the real load was on the locals...and they did a monumental job of getting things going again.

The island was hard hit, with many buildings being demolished and most of the banana plantations destroyed. Now, a year later, most of the serious damage has been repaired and the banana crop is one of the largest in their history. Banana plants grow new with each crop, so knocking them down only put them out of business for one season.

When disasters hit our country, it is amateur radio which takes over. For the first few days after the Alaska earthquake, even the Pentagon had to rely on amateur radio for all of its communications with its SAC base there. Military communications are concentrated and thus vulnerable. Other than that, what have we in long-range *and* short-range coverage? Only amateur radio can provide *all* kinds of communications...and even connect short-range with long-range if the need arises.

Police have short-range capabilities...as do most of the other mobile services. Even these various services have a relatively small contingent for each service and no way to interconnect with other services. When there was a big fire in Boston, the amateurs stepped in and provided the communications between the fire, police, and other agencies. None of them had any way to coordinate except via amateur radio.

Our country has a vested interest, I believe, in amateur radio being strong and developing a really powerful communications network...one where via digital switching any amateur with an HT or mobile unit will be able to talk with any other. I see no serious technical problems holding us back, only the access to a satellite...and I think that can be surmounted.

I've rattled on enough for now.

FOR A BAUDY TIME, CALL...

Now that we are permitted to use ASCII, perhaps it is time that we started taking advantage of it.

Assuming that you may not be exactly sure of what is involved in ASCII or why it presents any advantages for us, let me bring you up to speed. It all started an eon ago (1946) when W2BFD (John Williams) got some Model 12 Teletype™ machines that were being replaced by the then-new Model 15 systems. Rather than junk these noisy, dirty old klunkers, he talked Teletype Corporation into making them available for hams to use and experiment with.

John, being a crotchety genius, made a modest living out of reselling these units and servicing radios out of a tiny storefront in Queens, New York. His main interest was in designing circuits, so many of the hams who sent for equipment found themselves waiting a rather long time for equipment. Some never got their orders.

Oh, well, I'll write more about him one of these months. Getting back to those teletype systems...they used a five-bit code to print all of the letters of the alphabet, plus the numbers and some other special characters. This was in the early days of digital communications. If you figure two to the fifth power, you'll see that this gives you 32 possible combinations. That's enough for the 26 letters and six more characters.

A chap named Murray came up with a scheme to make this work. He set up a five-unit code for each of the letters, plus the space bar, carriage return, line feed, figures (uppercase), letters (back to lowercase)...and a blank. A gent named Baudot invented a somewhat similar, but quite different code, with the result that Murray's code is known as Baudot. It isn't and never has been.

Not only did we get Baudot substituted for Murray, but also we have the *baud* as a result instead of, perhaps, the *murr*. The baud rate of a transmission is the number of bits per second being sent. Thus, at 300 baud, our 11-bit ASCII code would give us a net of about 27 characters per second. With a word being defined as 6.1 characters, this is about 4-1/2 words per second, about reading speed for a slow reader.

With 9600 baud being possible (using some compression and expansion techniques) over ordinary telephone lines, the restriction of amateur radio ASCII to 300 baud seems ridiculous to me. We are still in the need to be deregulated so we can experiment with 1200 baud and higher speeds. There is no question we can go 9600 baud and stay within phone bandwidths, so let's get the FCC off our backs.

At 9600 baud, one character takes about 1.1 milliseconds. This piece of information, coupled with a recent study of amateur operating practices, gave me an idea.

Our ASCII character is made up of eleven bits. This breaks down to seven bits being used to actually indicate the character being sent. If you can whip out seven fingers and multiply by two, you'll find that this results in a possible 128 different characters which can be represented. This allows an ASCII character for each of our letters in both uppercase and lowercase, the numbers, plus a bunch of special characters and punctuation. Even so, there are quite a few unused ASCII characters which can be user defined.

What about the other four bits in our ASCII character? Well, number one is a "start" bit which tells you that hey, a new character is coming, get ready. Then we have the seven bits to indicate the exact character being sent. Bit nine is a parity bit. Thus, if we are using even parity, an extra bit would be used in this slot to even up the number of bits sent in the preceding seven. When you are using even parity, your system will set off an alarm if you get a character with an odd number of bits... telling you that something is wrong somewhere. The last two bits tell the system that it is time to stop.

Now, if we were to define one of these unused characters as an indication that the following characters actually represent a special ham message, we'd be ready for the next thought... which I hope is becoming obvious.

Since over 91% of the average ham contacts consist almost entirely of a recitation of the equipment in use, a request for a QSL card, a signal report, and such, why not encode this important information so each element can be sent as a single ASCII character? All we need is a simple lookup table and we have a way to save enormous amounts of air time. In 1.1 ms we could tell someone that we are using a 520 transceiver. One more 1.1 ms for the three-element beam. Since the request for the QSL is unchanging, we wouldn't even need to send that at all, thus saving 1.1 ms. With your increased ability to make contacts rapidly, every millisecond saved is a millisecond earned. Perhaps we could eliminate that 1.1 ms for the signal report, too, since anything under a 5-9 + + + is a downer and could affect that QSL card. You don't want to take chances unnecessarily... and the assumption of 5-9 + + + in lieu of any other information will take care of that problem, saving you an extra 1.1 ms.

Of course, about now I expect some fruitcake to suggest that when it comes down to it, we don't really give one damn what rig the other chap is using, so we could just as well save that 1.1 ms, too. Thinking like this could lead to further disintegration of amateur radio, with questions being raised about swapping antenna type (who really cares?), the weather (hey, we've got to talk about *something*!), and the name and location (what's the matter, are you too cheap to buy a *Callbook*?).

If you really want to get rid of the chaff, you're down to call letters and one single ASCII character... a 15-ms contact, including both calls and the single friendly all-purpose ham contact ASCII character. At that speed, we might be able to step up our ham contacts, setting new records for WAS, WAC, DXCC, and others of our worshipped awards.

At 15 ms per transmission, two being the minimum for any award-acceptable contact, we would not be able to do much better than 30 contacts per minute... no, I dropped a decimal point, make that 30 contacts per second. Whew! I thought we weren't going to gain much for a moment, since many of us are able to whip off 30 contacts per minute already.

Think of the benefits to contest addictees! We would be able to run contests in perhaps one hour instead of over a whole weekend. Or we might let contest ops operate during the first two minutes of each hour so they would get a lot of different propagation conditions during the contest. In one hour, if they are diligent, they would be able to make at least 108,000 contacts. This would result in a good score. If we extended the contest to four hours, they might be able to WAA... work *all* amateurs.

Actually, I'm sure that with a little thought we will be able to improve our encoding of ham calls and get them down to only three characters total. This could cut our contacts in length enough so we could whip out at least 60 per second, or over 200,000 an hour. DXCC in less than two seconds? Why not? Think of the fun it would be to work one hundred countries while you are sneezing.

Of course, there would be some problems involved with this, but nothing serious. It would take a fast printer to whack out the QSL cards to keep up with your rig. You might want to hook that onto the end of a small printing press so you could print them as you need them, thus saving on QSL storage. Or you might just want the printer to do the whole card and not use printed cards.

You could have your system sort out the contacts and print the cards in zip code order for bundling and shipping to the bureau. The League would have to set up automated systems to sort and forward cards... or possibly just the computer data on the contacts could be forwarded by radio to the QSL centers. In that way, the League would be able to have a computer tell them each day the winners of their awards and perhaps pass along to other organizations the calls of stations winning other awards such as WAE, WAZ, and so on. Then we wouldn't have to clutter our walls with QSL cards. We could stick computer printouts of our DX lists on the wall... all confirmed by the ARRL.

Are you ready?

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

It's September, and, pause for a drum roll, another RTTY Art Contest is about to begin! Every year, the Southern Counties Amateur Teleprinter Society (SCATS) of southern California sponsors this worldwide contest, and this year is no exception. Last year's winner of first prize was Bill Skipper, whose work is shown in Fig. 1. Other winners included Winky Merk AD4M, Klaus Zielski DF7FB, and John Burnside N3ATH.

Winners receive engraved plaques in recognition of their efforts and the satisfaction of a job well done. Interested in entering the contest yourself? Write to SCATS, in care of Mae Washburn WA6LNH, 5772 Garden Grove Blvd. #415, Westminster CA 92683 for rules. Who knows, maybe next year I'll be running your creation as the winner!

Every once in a while, a reader writes with a question about an old issue of *73*. Such is the case this month. N. L. Ferguson WB5VIY sends in the March, 1979, "RTTY Loop" column, and asks two questions about it. First, with regard to a simple UART-based scheme to send single characters, reproduced here as Fig. 2., N. L. asks how the "Push-to-Send" button on pin 23 works.

Once the Murray (nee Baudot) data is set into the UART, on pins 26 to 30, a pulse is needed to initiate data transmission. In this simple scheme, the "ground-to-send-" input, pin 23, is manually brought to ground by the push-button. This transition, high to low to high again, or press and release, generates the pulse that starts the UART. In a practical circuit, this pulse is normally produced by gating logic since the normal "noise" in a push-button would, in fact, produce many rapid fluctuations as the contacts settled. However, in this demonstration circuit, the function is adequate.

The other question regards several buffers used for isolating and/or inverting the TTL-level signal produced. Originally Fig. 4, this is reproduced here as Fig. 3. The buffer in "A" was originally mislabeled; it is a 7407, as correctly identified in the text. The 7407 is an open collector buffer, useful in isolation. The figure originally branded this as a 7402 which is a NOR gate—quite a different animal.

Along the lines of old publications, Kevin Carey of Rush, New

Fig. 1. SCATS 1980 1st-prize winner.

York, is trying to build an old tube-type converter out of the old *RTTY Handbook*, published by *73* in 1972. This circuit used TV sweep coils, about 30 mH, as mark and space filters. Kevin writes that the value of the parallel capacitor for the 2975-Hz filter is given as 0.07 uF, but that the capacitor for the 2125-Hz filter has no value stated.

Kevin, these coils are adjustable, and I used some in a converter I built about fifteen years ago. The value of the capacitors really is not that critical. You might try 0.1 uF for the 2125 Hz and 0.15 uF for the 2975 Hz and trim if you have to, remembering that disk capacitors may be off by 20% or more from what they are marked.

Kevin also wanted a basing diagram for the mixer resistors—these are 100k. As far as where to get these coils, try a local TV service shop, preferably one that has been around a while and might have a stock of "junk" sets to pull from. It never hurts to ask.

Before you hustle along to build this converter, though, let me add a word or two of caution. This is a basic converter of an earlier age. Similar performance may be obtained with simple circuits based on more modern devices such as transistors and phase-locked loops. Although I feel that building a tube-type converter may be a valuable learning experience, it also can be frustrating as the devil. This is more true today with the proliferation of solid-state devices. You may want to wait for a bit for *73's* new *RTTY Handbook*, due out in the near future, and look through that for some other ideas.

This same piece of advice is directed to Bill DeVore WB3DLO, and the many others who have written about their search for RTTY publications. Bill is trying to rewire a Model 19, a subject we talked about in this column several years ago, and needs a diagram to follow. While it is too much to include here in RTTY Loop, that is just the kind of information you will find in the new edition of the *Handbook*. New information on computerized RTTY also will be included, along with modern circuits and ideas. Look for an announcement in the *73* Bookshop section of the magazine, I hope before the end of the year!

I received a letter from a Canadian ham who is a CW and phone operator who greets RTTY signals with less than enthusiasm. He states that "we made great progress in eliminating AM carriers by using SSB and supplying the carrier [in the receiver]. Do you think something similar to SSB could be done for RTTY? A steady tone supplied by the receiver, and the incoming marks alone used to key a Schmitt trigger and shift the receiver's tone oscillator 170 Hz. Many advantages all along the line could come from this system on low bands."

Unfortunately, this question reveals a lack of understanding of how RTTY works. Putting aside for the moment the fact that on-off keying, what the writer is requesting, is illegal, let's examine that mode of transmission. While idling, a steady mark is generated in both FSK and on-off keying. They are, on the air, identical. Transmission of a character pulses the mark carrier, again identically. However, with FSK, an inverse signal (the space) moves a carrier a fixed distance (typically 170 Hz) away from the mark. When the mark is present the space is not, and vice versa. They are never present together, thus presenting the image of a single carrier being moved (shifted) in frequency: frequency-shift keying.

The advantage of this scheme is, among other things, the built-in redundancy of the system. Interfering signals would have to obliterate both the mark and space in order to destroy information. With on-off keying, a single carrier sitting on the mark frequency would render communication impossible. While such a carrier is annoying with SSB, it is devastating with on-off RTTY. Using modern reception techniques, an FSK signal would not even be bothered.

Looking at it from the other side, I cannot see how a good CW signal (RTTY is normally not found in SSB segments) could be copied better through an on-off-keyed RTTY signal than an FSKed one. On-off-keyed RTTY would sound like high speed CW, certainly confusing nearby Morse transmissions. Narrow receiver filters at the CW station should be able to eliminate nearby RTTY signals just as they notch out nearby CW ones.

I'm sorry that I don't agree with you, but I hope you understand why. You may benefit from some reading on RTTY; who knows, you may join us!

Several questicns have been received about current VHF RTTY possibilities. Along those lines, allow me to plug the two-meter repeater of AMRAD, located in the Washington, DC, area. Although well known for its work with OSCAR satellites, AMRAD also is on the forefront of digital communications, as typified by its repeater on 147.21/147.81 MHz. I am told that a packet radio beacon is currently on, using Bell 202 standard tones. Also, Sunday night bulletins are transmitted at 6 pm local time. If you're in the area, have a listen.

Some more from these keys next month. Tell me what you'd like to see, then look for it here, in "RTTY Loop"!

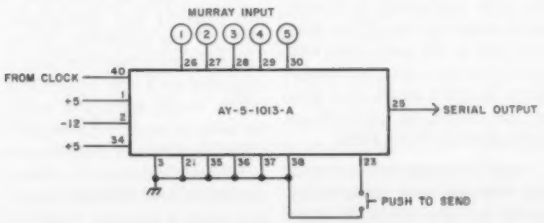

Fig. 2. UART sending scheme.

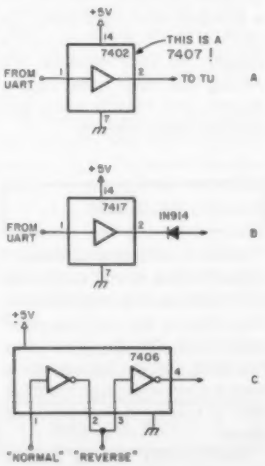

Fig. 3. The buffer goof.

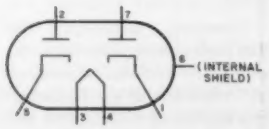

Fig. 4. 6AL5 basing diagram.

LETTERS

WAIN WHEEL?

What year did you invent the wheel?

You're responsible for every new development that has ever taken place in ham radio, if you do say so yourself.

You can be sure that many, many hams are sympathizing with and feeling very sorry for you because of your severe psychotic condition.

Bill Libman KA1JE
West Hartford CT

It's not as bad as you think. Aspirin does the trick . . . don't worry.—Wayne.

UNTRUSTWORTHY?

Can we be trusted?

Docket HR2203 seeks to reaffirm the FCC's current practice of allowing licensed hams to conduct the tests that lead to the Novice certificate. But clearly, too many of us have shown ourselves to be untrustworthy in this area. As proof, witness the dreadful CW on the Novice band. Some of it drags along at 2 to 3 wpm, with awful format and spacing, long pauses, and repeated errors. These people came nowhere near passing the 5-wpm code test that the FCC entrusted us to conduct.

You can almost see the nodding, grinning, and winking that went on between the hopelessly under-qualified would-be Novice and his licensed buddy who faked the results. This is a serious accusation, but the resulting shameful performance on-the-air proves it. The Novice test is the only area in which we have been allowed to demonstrate our ability to police ourselves. We have betrayed this trust many times. Again I say, listen to the Novice band for proof.

Therefore, I recommend that this self-policing privilege be withdrawn from us. Alternatively, I recommend the following: The section of HR2203 that will allow hams to monitor violations of the Act should be expanded to include monitoring of Novices who violate standards so badly that clearly they could never have passed a legitimate test. If a dishonest licensed ham knows that he could receive a letter from the FCC asking about the incompetence of his Novice friend, he will never be tempted to betray the trust placed by the FCC in him—and therefore in all of us.

Peter Vaughan KC4PX
St. Petersburg FL

Peter, I think you are being very harsh. Perhaps you don't realize just what is involved in being a Novice. This is an introductory license where hams can learn. Yes, some Novices make mistakes (I know I did)—yes, many Novices have abominable fists (so do many Extra class licensees)—but the Novices you hear on the air are communicating, and in the process are learning to be better operators.

The poor fists you hear are largely a result of the FCC's way of handling Novice exams. There is usually a 12-week wait between passing the code test and receiving a license. In the meantime, our new hams are getting rusty if they are not practicing.

We need more seasoned hams to take the time to help Novices get good fists and set up their stations. After all, we aren't born with these skills. Six years of teaching new hams has taught me that Novices are among the most enthusiastic, honest, and friendly hams you will ever meet.—N8RK.

OL' SOGGY

After a hard day at work, I rushed home to my DX300 for the latest news of the Whiskey Jack Rescue Net. I am happy to report that Old Soggybottoms has been found. There came a flash a short while ago that 6605 was in tow by a French naval vessel.

Here comes the fly in the soup. One operator, a sandbagger something or another, was saying that it should have been *our* Navy or Coast Guard to save Soggybottoms, not the French. Gee, I thought the whole purpose to this Mayday Net was to help find Soggy 6605, not to designate who! The way this lid was carrying on, one would think that a French naval vessel was a French ship with a cargo of belly-button lint!

Now, to answer the question of why the French ship was there first, that's because our Navy has landed on Greenland—yes, Greenland. Let me explain. Five kHz up, there were three high-powered WJ stations planning their rescue strategy. The head Jack of this group proposed to wait till 6605 transmits again, then with their beams *"tripodulate"* on him. He suggested that they pool all their readings together and plot his position.

Down 5, commands Capt. Jack, and the three are off to tripodulate. (Makes me think of Tinman, Scarecrow, and the Cowardly Lion, for some reason—oh well.) Out of the QRM comes the long-awaited transmission and the three get cranking. Now, remember that these masterminds are many states apart, so one takes the long path, one takes the short path, and the other takes a standby for Mother Nature. The all-important transmission over, they plot 6605 at 70° north by 45° west.

Where's that, asks the nature boy? I'll be darned if I know, replies Capt. Jack, but let's get it off to the Navy quick! Has it come to light yet? No? Then read on.

The Navy receives this valuable information, and they're on the way to Greenland taking along a few Marines in case Soggybottom is beached. Where's the Coast Guard, you ask? They're busy keeping our shores safe from unfriendly powers while the Navy is on this life-saving mission. While all of this was happening, a French naval vessel (whose captain was oblivious to the past 5 days of radio lunacy) is patrolling the Atlantic shipping lanes. And who do you think he happens to come across? Right. 6605.

I hear Ol' Soggy was going to stay with his boat while being towed, but one fellow WJ suggested that he take the cat and pass it up to the French ship, and *then* his boys, wife, and himself should follow. (Makes you wonder about this guy's priorities, huh?)

For those of you who like a happy ending, 6605 and family are home safe and sound, and the Whiskey Jacks are congratulating each other for doing such a fine job—over and over and over again.

In closing, I ask—How can anybody say the 10½-meter boys don't perform a valuable service? It is said that laughter is a very potent drug, and after 5 days of complete confusion, power battles, and radiomanship that bordered on incompetence, I am well medicated!

The 10½-Meter Reader
New Jersey

BOTSWANA BOOSTER

The March, 1981, edition of *73 Magazine* has just reached the bookshop here in Gaborone, and your editorial has prompted me to write to you about amateur radio in Botswana.

The Government of Botswana has no fear of personal communications. Both ham radio and CB are permitted here. The support for ham radio by Botswana delegates at WARC '79 was welcomed and commented upon by several other countries. The Government is aware of the benefits that can be gained from ham radio in the training of technicians.

However, sympathy on the part of the Government and visits by influential people such as yourself or Bruce Johnson (whose visit here was reported in the September, 1979, *QST*) are not enough. There must be a core of already-licensed hams in the country who are willing to foster interest in the hobby amongst the emerging technicians and engineers and who appreciate that this process may take many years.

What must be overcome is not hostility but indifference. One of the problems we encounter here is that ham radio is regarded as a rich expatriates' hobby. Young Batswana see little point in becoming interested in what appears to them to be an expensive indulgence. Please remember that hobbies are, in any case, a concept foreign to Africa. Also, it must not be forgotten that the majority of

people here do not have electricity in their homes and that components and surplus equipment are virtually unobtainable even in the capital city. In addition to these drawbacks, a large proportion of young people receives no secondary education whatsoever, although that situation is improving. Thus, ham radio can be expected to appeal to only a very small minority of the population at present.

In spite of all these difficulties, the expatriate hams here are doing their best to interest Batswana in the hobby. There are at present three Batswana with ham licenses. A further one has passed the Radio Amateurs' Examination and has only to pass his Morse test to obtain a license; three more retook the RAE on May 11th and await the results. A further three are studying for the examination. It also is hoped that a Novice license will be introduced, as there are about 30 school students who are eagerly awaiting this development. This Novice license would be similar to the American one.

The Botswana Amateur Radio Society was formed in 1976 and has been really active for about two years now. Virtually every ham resident in Botswana is a member of the Society, a total of about 20, and a number of interested Batswana who do not yet hold licenses are associate members. The Society has just managed to buy premises to use as a club room in Gaborone. This will not be of much immediate help to those outside the capital, but it is felt that a club station would do much to encourage interest here and that a really interested and active membership in Gaborone could then encourage activity in the other main centers.

A further point: In our more depressed moments it frequently seems that the main reason for external encouragement of ham radio in Africa is the generation of support at ITU conferences and additional DXCC fodder. It is difficult to demonstrate the ham spirit behind a DX pileup when you are on the receiving end of it.

(Mrs.) Pru Harris A22PH
Gaborone,
Republic of Botswana

The situation you describe is a familiar one...and is repeated in most Third-World countries. It has a solution. Even in Jordan, which is a wealthy country as compared with some of those in Africa, it is beyond most youngsters to aspire to a home station. This is why club stations were put in by King Hussein in every city in Jordan. These were set up in the youth clubs. Although there was some criticism of the CIA for furnishing Hussein with funds, I happen to know that many if not all of these ham club stations came from this fund...well spent, to my way of thinking.

The next stop is an inexpensive one. The government needs to have a person who can get to these club stations about once a week to give classes in amateur radio. Jordan had one chap who did this...and did a fantastic job of it. He taught the fundamentals of theory and code. The students eagerly learned and got familiar with hamming through operation of the club stations.

If any country is interested in this concept, I would like to talk with them about it. I believe that I can get US amateurs to donate the money to set up club stations if the donors are promised a later visit to see their club station and to meet the amateurs who have resulted from their generosity. I think we can put together excellent club stations for about $2,000 each, with rigs, beams, towers, rotors, and so on. I've asked many groups about this and have always had plenty of volunteers to come up with the needed funds.

Thus, there is no problem with a lack of ham gear for personal stations...or power. The youth clubs have power and a person to be in charge of the club station.

The youth quickly are attracted to the wonders of talking all around the world via the club station...and tackle the theory and code programs with enthusiasm. For the long run, they are now on the path toward most rewarding careers as technicians and perhaps even engineers. These Third-World countries need technicians desperately. The main problem facing them is motivation...and amateur radio sure can provide that.

A few days ago I met with the Prime Minister of a small country in the Caribbean and I outlined my plan. He was most enthusiastic. I will be pursuing this, and it if works out I'll be after you, the readers, for some donations to get ham club stations set up. I'd like to see this scheme tried out in a hundred small countries. Amateur radio needs it...and so does the world.

The pileups are another problem.—Wayne.

AFRICAN CLASSES

We noted your comments re license classes with interest (April, 1981). The Johannesburg Branch of the South African Radio League offers every six months three different courses leading to the radio amateur operator certificate examination. All lectures are coordinated, advertised, and run by the SARL-Johannesburg for the benefit of intending amateurs and the club and its members.

There are no "hidden" charges, and the fee of R45 includes the lecture material. All the student has to buy is a pocket calculator at about US$12. No company is involved, and the venues are private colleges with the exception of our special course in Soweto, where courses are offered at Molapo Technical Centre to save the students the long travel time. This course is free of charge.

Lectures are selected to bring the students in the shortest possible time up to exam level. The lecturers are selected to have the right psychological profile to enable the students to gain the right attitude to his/her future fellow hams.

The lecturers are paid a fee of US$18 to US$22 per each two-hour lecture, and are expected to check the students' homework.

Our lectures start each year in late January and end in July or early August. The exact date depends on the school holidays. Our club has been offering courses now for over 7 years. The tremendous growth of ham radio, in particular in the greater Johannesburg area, speaks for itself.

Peter Strauss ZR6MI
Johannesburg, South Africa

ARRL OK, BUT...

Attached is a letter which I sent to Robert York Chapman W1QV, President of the ARRL foundation, in response to his appeal for contributions for OSCAR. I think OSCAR is great. I will contribute. Also, I would like to see our house cleaned up. When Dannals and Metzger resign, the fog should abate somewhat. *I urge all ARRL members to write to their directors demanding the resignations of Dannals and Metzger.* The League is a great institution for continuing ham radio as we like it. We don't need "rubber stamp" directors, "closed-door" forced "kick-outs," and uncounted "vote shredding." Let's end dictatorship and return to some kind of decent ethics.

[The letter to Mr. Chapman supported Don Miller and said that the $17 contribution for OSCAR suggested for ARRL Life Members would be exceeded and mailed in as soon as "Mr. Metzger and Mr. Dannals have resigned."]

Ronald C. Williams
W9JVF/ZB2CS
Indianapolis IN

Troublemaker.—Wayne.

JOBS OUT THERE

I hope it's not too late to reply to a letter in your issue of May, 1981. I'm referring to John Townsend's letter (Getting A Job).

I don't know where he is looking, but the man is certainly not including broadcast stations in his definition of "an industrial outfit who needed a competent electronics man." I have had, for almost a month now, an opening for an engineering assistant. The requirements aren't severe: just the knowledge to do the job and an FCC First Class Phone. No experience? Not to worry; I'll train you.

In my search (believe me, there just aren't enough people out there to meet even my minimum requirements), I found many stations which also were looking for engineers...just within a 150-mile radius of Dayton. Part of my search consisted of calling these stations, hoping that maybe they had had a recent applicant that they could point my way.

Our starting salary (typical) for this job is $250 to $300 per week (higher scale for someone who *does* have experience)—somewhere between Townsend's experienced political

technician and the Phi-Beta-Kappa Double E...and neither applicant need either have minored in politics or worked 15 hours a day in Nome. I make over $400 per week, and I am not related to the boss nor am I one of his buddies. I also can move under my own steam and motivation. His secretary and I are not having an affair, and I am not a member of a minority.

Age? No problem. One of my applicants is 63. He is highly qualified...but, when I tried to call him back for an interview, he was never in and wouldn't return my calls. I would have hired him in a minute!

There is nothing wrong with feeling sorry for oneself, but, Uncle Wayne, when things have been going wrong for a long, long time, why don't people stop, look at themselves, and think that's perhaps where they should be pointing the finger?

Would I hire John Townsend? With that attitude? Would you?

Patrick J. Shirley
Chief Engineer, WONE/WTUE
Dayton OH

FREE TOROIDS

The public services performed by radio amateurs are recognized by the Chesapeake and Potomac Telephone Company of Maryland, which has donated a large number of 88-mH toroidal inductors for their use.

Superior passive CW filters using these coils have been described by Ed Wetherhold W3NQN in *HR* (April, 1981) and *QST* (December, 1980). He is a filter design and applications engineer with Honeywell, Inc.

Ed is giving generously of his time in packing and handling the eleven toroids per carton. Your only cost is the shipping. Send an SASE for instructions to: Ed Wetherhold, 102 Archwood Avenue, Annapolis MD 21401.

Gene Brizendine W4ATE
Huntsville AL

CABLE QRM

For those of you who thought that your TVI problems would go away when your neighbors went on cable TV—'taint necessarily so! I recently ran into an unusual TVI problem here in San Jose that involves a local cable company and its channel assignments. This TVI problem will create a serious situation for amateurs if action is not taken now.

The cable companies have a group of channel frequencies between TV channels 6 (88 MHz) and 7 (174 MHz) which they normally designate as channels A,B,C, etc. These channel frequencies are more or less standardized throughout the cable TV industry. The cable companies use these channel frequencies for their premium offerings such as HBO, Show Time, etc. There seems to be no industry standard as to what offering goes on what channel. The cable companies use downconverters at the subscriber locations to pick off the desired channel and downconvert it to TV channel 3.

My problem is with cable channel E which is used for the "Movie Channel" here in San Jose. (On other cable systems, channel E may be used for any premium offering, as mentioned above.) The problem is—believe it or not—channel E's video is on 145.25 MHz and the audio is on 149.75 MHz! This means that the downconverter's front end is tuned across the entire two-meter band. Tests indicate that 1 Watt will wipe out E to 100 feet, 35 Watts to two blocks, and 130 Watts to five blocks. (This is true with *any* two-meter frequency.) These tests were made with my neighbor after the local cable company had replaced all its coax and checked all its grounds. I wonder how bad the results would have been had we made the tests before the coax and grounds had been restored to like-new conditions. By the way, tests at locations with underground coax systems produced about the same results.

In order to get something done here, I had to set up a conference call between the local cable company and the FCC. The end result was that the FCC told the cable company to correct the problem. I don't know their plans after conducting tests at my QTH other than the fact that they want my neighbor to switch to another offering to get away from the interference.

There is no way that this channel E and two meters can coexist. We don't want another 6-meter and TV-channel 2 situation. So—what I'm asking is that if you have this problem, or know someone who does, please notify the local cable company. If necessary, mention FCC Rule 76.55A1 which pertains to this problem. They need to know just how bad this problem is. Also, please notify the FCC and the ARRL.

We need to face this problem now. Cable is the coming thing, and we need to establish the ground rules now before additional channels are created on the other ham frequencies.

Bill Rinker W6OAV
San Jose CA

Not only are some cable systems very susceptible to interference, but many of them radiate harmonics that interrupt amateur communications. Any suggestions?—N8RK.

BOO TO HOME BREW

I'd like to say a few words in defense of store-bought ham gear.

It seems kind of fashionable these days to heap scorn on so-called "appliance operators," who offend the old guard by not personally building all their transmitters and receivers. At one time, everybody built everything, because that was the only way to get hold of the stuff at a price within the average ham's budget. It was more a necessity than a virtue. The practice had several undesirable side effects.

First, it limited the sophistication of a piece of equipment to the amount of time the owner could spend on designing and building it. The entire cost of development was spent on one single piece of hardware; there was no way to amortize part of the cost over a large run of units, except for the occasional club group project. Guess why things like bandpass i-f filters never caught on until the late 50s?

Second, it limited the amount of testing that could be done to whatever was within the capabilities of the test gear the owner could afford to buy, build, or borrow. Guess what? Spurs all over the place, and mediocre audio.

Third, it slowed the building of equipment enormously, because each assembly job was cut-to-fit using the simplest hand tools. There was no opportunity to tool up for a design and build up some speed. So, a damn sight less equipment got built, and fewer people were willing to bother in the first place.

And where are the virtues of home brewing what can be bought? How does the world benefit from having yet another Novice design and build a CW transmitter whose circuit is essentially the same as the thousands that have been made since 1925? Does anyone seriously think that this kind of project teaches anything applicable to keeping the real workhorse gear—synthesized FM rigs and broadbanded sideband transceivers—working right?

Home brewing was a stage ham radio had to pass through in order to get off the ground, but it never could have grown up to be a serious, reliable, useful form of communication if it hadn't grown out of that stage. Today's gear would be neither adequate nor affordable if there weren't a way of concentrating more effort on its development and construction than a single individual can bring to bear, nor would there be enough hams to supply an adequate response when a disaster strikes.

There's still home brewing, of course, and for good reasons. Ham technology continues to advance, and at the cutting edge the market is small and commercial equipment doesn't exist. When a piece of gear is needed, either for a test or for regular use, and it can't be found, that's the time to get out the reference library, the desktop computer, and the scope. But to build *everything*? We'd never get anything done! Sure, ham technical talent is capable of equaling any professional talent on any task, but let's concentrate that kind of effort where it's needed instead of trying to lay guilt trips on people who are really bringing the strength of diversity to our hobby.

John A. Carroll AB1Z
Bedford MA

Right on, John! Although I truly enjoy home brewing accessories and other small projects, I have no interest whatever in designing and building my next HF rig. I'd rather concentrate on the human side of our hobby, which is every bit as important as the

technical side. Hams are still doing plenty to advance the state of the art. Satellites, microwaves, spread spectrum, moonbounce... there is no shortage of challenging frontiers.—WB8BTH.

SCOUTING HELPS HAMS

Your May editorial calls for clubs to entice young people into the ranks of amateur radio operators. You listed a number of activities for young people which you regard as distractions from ham radio. One of the activities listed was Boy Scouts. Rather than being a distraction from ham radio interest, Scouting can become a tool in developing new hams.

Radio clubs which wish to actively pursue new young operators should encourage their members to become certified with their local Boy Scout Council as Communication Merit Badge counselors, or the club should sponsor an amateur radio special-interest Explorer Post. Boy Scouts are young men from age 11 to 18, and Explorers are young men *and* women from age 14 to 21.

My experience with Scouting as a leader encouraged me to earn my ticket at the age of 33. Please don't put Scouting down; encourage the ham radio community to get involved in Scouting.

John C. Mullan KA2MKU
District Commissioner
Fuertes-Frontenac District
Baden-Powell Council, B.S.A.
Ithaca NY

On my honor, I will do my best...—N8RK.

LOOKING WEST

Bill Pasternak WA6ITF
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Suite 718
7046 Hollywood Blvd.
Hollywood CA 90028

Dedication: I wish to dedicate this month's column to the memory of my friend and writing colleague, Ray Thill WA9EXP, who died tragically on Sunday, May 31, 1981. Ray was a very special person to many of us. We loved him and we will miss him very much.

In last month's column, I mentioned that I had heard the audiotapes of Dr. Dave Gardner's ill-fated Palmyra DXpedition in 1979. In fact, I spent a little over 50 working hours editing them into a form that Dr. Gardner could use in talks he was planning at that time.

The tapes were recorded by another amateur here in Los Angeles, Bernie Abrahamson W6PJX. Bernie used 2400' mylar™ reel-to-reel tape which ran at a speed of 3-3/4 IPS. He captured much of what transpired during that time including most of the emergency communication between Palmyra and the US mainland.

Editing the tapes into usable form meant first transferring or "dubbing" them from 1/4 track to full track; I upped the speed to something workable for editing purposes, grouping emergency contacts with one another, DXpedition contacts together, etc. This was done by listening to the tape and hand-cutting pertinent sections together on separate reels.

The next step was the most time consuming: removing parts which contained nothing but dead air, totally unintelligible communications, and material not really pertinent to the operation. The equipment used consisted of a Tandberg Model 6 for playback, a Sony TC-250 (full-track converted) for recording, and a modified Sony TC-155A with an Edit-All S-2 block for assembly. (By the way, for those of you outside the broadcast industry, this is called "Assembly Editing," aptly enough.)

The final work was to transfer the many completed open-reel tapes onto standard audiocassettes. For this, the Sony 250 was played through my Vanco Port-A-Board mixer into a Panasonic RS-260-US stereo cassette deck which was parallel-channel connected for monaural recording. As you can tell, this was quite a chore. In fact, over 600 splices were involved in making the raw original into a form usable for discussion and evaluation purposes. Obviously, over this 50-hour period, I became intimately aware of much of the DXpedition's experiences and the problems it faced.

Two things that stand out in my mind were the numerous instances of interference to DXpedition emergency communications—interference that was obviously of the intentional kind—and other instances where amateurs seemed far more concerned about when DXpedition operation would commence than about the welfare of those who were stuck on that isolated rock. The thought of a contact to that rare location seemed to cause many amateurs to lose all common sense. The 5-second contact and hoped-for QSL seemed to replace all sense of reason for many.

I was really appalled by some of what I heard. I find it hard to believe that human beings, hams like myself, would value a lousy piece of paper over the lives of a group of fellow amateurs. Nor were these the only instances of disregard. Some of the disregard was for the amateur rules themselves, such as calling the operation *on frequency* for a contact while operation was below the US phone band. Also, the sometimes downright nasty comments by those who committed the same regulatory violation in order to get the original offender off the frequency.

Since the bogus QSL card story broke, I have spoken with many hams about it. Opinions vary from "How could they possibly have done this to the DXCC program?" to a simple "Right on... it's about time someone cleaned up this ARRL-created mess." Most comments have fallen somewhere in the middle, like, "Now that it's all in the open, maybe we have a chance to revamp things a bit to make it less competitive and more in line with the basis and purpose of amateur radio."

I think these are the people who are on target. I see nothing wrong with having a sport in amateur radio—a sport called DXing. But when this sport becomes an obsession and causes so many to lose all sense of propriety, then the rules by which the game is played must be changed.

Most of those into DXing with whom I have spoken feel that two changes are needed. The DX Advisory Committee rather than the General Manager must be the entity to decide on the validity of a country or place for DXCC credit, and the DXCC Honor Roll must be eliminated. This, they say, would keep the sport, make it even more democratic in the judgment aspect, and take away the razor edge from the competitiveness.

They are the experts in this one, not I. If I ever get back into DXing it won't be from this QTH because of antenna restrictions. It will be on my old friendly 6-meter band only. As I wrote once before, the HF DXer could learn a lot from his VHF/UHF brethren with regard to cooperation. Many VHF/UHF DX records attest to this. Ask people like WB6NMT or N6NB if you don't believe me. Cooperation is how the records are set. That's how everyone gets his slice of the pie.

SECOND-CLASS CITIZENS

Some three years ago, a friend of mine decided to run for the ARRL Vice Directorship in his division. He went through the nominating process only to be declared ineligible because he held a Technician-class, not a General-class, license. He thought he was eligible to run for that office because, according to the ARRL, there are only two classes of membership: full members, who are any licensed amateurs, and associated members, who are unlicensed and therefore cannot vote for either Director or Vice Director.

(By the way, Newington, in case you have never read your own paperwork, nowhere can I find anything regarding SCM elections. Does this mean that an associate member can vote for SCM?)

My buddy was, and still is, very active in local amateur radio affairs. He spent years working in AREC (now ARES), organized communications for walk-athons and other civic events, has been active with many radio clubs, and is currently the presi-

dent of one. He is a person who gets things done and he felt he could do even more. So, when he was rebuked by Newington only because he did not hold a General-class license, he was rather upset and planned legal action on what he felt was an obvious contradiction between the League's corporate charter and their operating rules. The cost of such litigation caused him to decide against it, so we will never know if he would have been elected or not. He was popular, but so was the incumbent. Both were good men. But this has caused many amateurs to wonder if the ARRL isn't guilty of something called "License-Class Bigotry," discriminating against an individual because he or she does not meet certain arbitrary criteria set forth by the League hierarchy.

I must ask: How many Novices and Technician-class operators are there who would gladly serve in an elective post if not for this restriction? (A restriction enacted by the Executive Board, and not one that appears in the ARRL's corporate charter!) One of the excuses often uttered in defense of this policy is that Novices and Techs cannot operate on certain bands where League-function networks are held. That may be true today, but we are entering a new era, one of amateur communication by geosynchronous satellite. It won't be too many years before the 80-meter nets are a thing of the past, having been replaced by similar on-the-air conclaves via satellite. The entire future of the Amateur Service really lies in space communications, and these are frequencies that the Tech can and does operate.

Believe it or not, there are people who have no interest whatsoever in operating on any band below 50 MHz. They view HF as a zoo, a place to be avoided at all costs. Hence, they see no need to upgrade. Many never will. Yet these very same people are ready, willing, and able to lead. They want to lead. They have the ability to lead.

I can only wonder what excuse the ARRL will have for keeping these people as second-class citizens some 10 or 20 years down the pike. As I and many others see it, another change needed in the ARRL is for an end to this type of license-class discrimination. People must never be judged on their ability to copy 13 words per minute as is now the case. If you are going to set some criteria, then they must be overall, and the most important point is willingness to serve.

My buddy didn't have the financial wherewithal to make it stick, but one of these days a Novice or Tech will come along who will. It may take such action if HQ doesn't wake up to the realization that we are in a new era. The 1980s. An era of split-second communication. A time in which amateurs are attuned to what's happening around them. Many of today's amateurs, regardless of license class, are politically active. They want and demand to have their voices heard, and if the ARRL doesn't attune itself to this, then one of these days there may be a "court ordered Novice in Newington," with everyone else up there wondering how it happened. The electoral process needs drastic revision. Ending the license class requirement to hold office would be a major step. I can only hope it's a voluntary one initiated in Newington, and not one that is eventually court ordered. There are better ways to see my dues spent than on protracted court battles.

By the way, I have no interest in becoming an ARRL official, nor am I eligible under Rule 11, with which I agree for the most part. Those of us who make a living, even in part, from amateur radio, should not run for such offices.

There are some exceptions I would like to see made even here, however. A few months ago, Wayne alluded to the true story behind the 1980 Southwest Division Vice Director's race which saw Gordon West WB6NOA disqualified from candidacy that time. I don't have the time this month to go into it extensively, but I will in the near future. Suffice it to say that Gordon was disqualified because, as editor of *CB Magazine*, he decided to use that vehicle as a way of helping CBers who wanted to get their amateur tickets. To that end, he began publishing a license-training course using training material from the League itself. It was in part because of this that he was disqualified. There's more, but we'll get into it later on.

I'd like to invite you, the reader, to voice your feelings about the ARRL and what direction you feel it should take in the decades to come. What changes are needed, if any? I have my views. I invite yours and will be happy to print them in this column as space permits. It's your League and mine. Let's tear down the "codfish curtain" together and make the ARRL play.

KAHANER REPORT

Larry Kahaner WB2NEL
PO Box 39103
Washington DC 20016

PLAIN LANGUAGE REVISITED

The first time that I read through the plain language rules' comments in February, the red vinyl FCC binder was thin. I checked again in late June, and it took four, fat loose-leafs to hold it all. A torrent of letters arrived at the last minute even though hams had since December (theoretically, at least) to comment. That's not unusual, however; most petitioners wait until the cut-off date. But in this case, hams largely ignored the plain language proposal until recently.

Several amateurs asked for a six-month extension for comments, saying that they couldn't get their hands on the *Federal Register* issue in which the rules were published until March. In addition, some said their clubs got bogged down printing and distributing the 50-page document to members because of the rule's bulk.

The FCC denied all extension requests. They said the rules were out for public comment for nine months (again, theoretically), much longer than other proposals and that the amateur community wouldn't be served by further delays.

However, Carlos Roberts, Private Radio Bureau chief, showed compassion. When the ARRL asked him to reconsider their petition for extension—this time they only asked for two extra months—he agreed. By the time you read this, that extension will have expired (August 21), and the "replies to comments" period begun.

With so many comments to wade through, I couldn't get an accurate count on the definite yeas and nays. Most comments seemed somewhere in between, with hams liking some parts, despising others. Some just wanted to trash the whole thing.

One objection stood out, though. Overwhelmingly, hams took exception to the text's beginning in which the commission dropped the traditional principles and reasons for amateur radio spelled out in Part 97: promotion of international goodwill, public service, perfection of communications technology, and so forth. The new rules just leave it this way: for the satisfaction of the operator.

Many commenters deemed that to be too simple a statement for such an important facet of the service. They believed the FCC's new approach too basic, that it lowered the Amateur Service's stature to that of the CB Service, noted several hams. Their pride hurt. Their egos ached.

In a more practical vein, however, other hams pointed out that when the time comes for amateurs to defend their frequencies—as they must often do when another service believes it can make better use of the ham bands—intruders will look at the given official reason for amateur radio, and then use it to show the frivolous and self-serving nature of the service. Also, they added, to those who know absolutely nothing about amateur radio, the statement of purpose doesn't say anything substantial, doesn't teach an outsider anything.

I talked with Roberts about the plain language rules, and he assured me that the commission staff remains open-minded. "That's why we put the rules out

for comment," he said. He emphasized that the proposal isn't etched in stone—not by any means—and that before the rulemaking period ends, he expects changes, both in wording and in substance, based on comments.

What the FCC really looks for in comments is not "I hate any change; I hate the new rules" kind of letters, but the "I hate the new rules because..." types. Or, "I like the new rules except for ..." So, keep those cards and letters coming in. And be specific.

And a word on comments. It's a rich-man's game. The FCC doesn't make it easy for private citizens to read filed comments so interested parties can reply. The only place dockets are kept is in Washington, DC, at Commission headquarters. If you live in Seattle, you're out of luck unless you maintain counsel here. And that's precisely what broadcast stations, common carriers, and others do. It's spawned a whole new industry. Lawyers make their living just following rulemaking for their clients, duplicating letters, and mailing them out. (Actually, lawyers often hire college students at cut-rate prices to do the legwork.)

One trick attorneys use to make life easier is to intervene in a rulemaking—make a comment, any comment. Then, following the rules of professional etiquette among attorneys, you become part of the "service" list and anyone who comments afterwards automatically sends you his filings.

Well, what started this whole plain language thing? Why did the FCC decide to rewrite the amateur radio rules in the first place? The stock answer that Commission staffers give inquirers is that it stemmed from an executive order. That's Washington talk for "the President told us to do it."

In this case, that's quite true, and when I jog your memory you'll recall it. The Carter administration was hot on the idea that legalese was becoming too foreign a language for government documents that affected the public. Carter declared that federal agencies should begin programs to rewrite rules in plain English. The FCC took that edict to heart (other agencies, unfortunately, didn't) and started work on the CB Part 97 rules and those governing maritime radio operation. They did such a good job on the CB rules that the President held it up as a model for other agencies to follow.

So, the commission, reeling from all the executive attention, decided to expand the project to the next logical area: amateur radio. Because of its strong general public interest, it seemed the next likely candidate.

FCC staffers took the President's order seriously and attacked Part 97 like it was part of an etymological holy war. They can't turn back now even if they wanted.

With budget cuts keeping people running scared, afraid to even hint that they were wasting public monies, stopping the plain language rulemaking now would be embarrassing. Too much time, effort, and money have been invested already. Also, a large number of FCC staffers still loyal to the Carter administration intend to carry out his order. In addition, the FCC boasts that they rewrite better than anyone else and vow to keep it that way, pal.

No matter how strongly you ask the FCC to stop the rulemaking, no matter how much you yell and scream, chances are slim on dropping the matter. My guess is that it's going to happen whether you like it or not. So, again, keep those cards and letters coming in. It's your only chance for a fair shake.

NO CODE, NO WAY—ALMOST

It comes in cycles. For some reason, the amateur community is once again talking about a no-code ham license. It could be because of the '79 WARC decision which allows dropping the code requirement for licensees transmitting above 10 meters. That international rule takes effect in 1982, and the FCC can, if it wants, follow it. However, WARC doesn't allow no-code for 10 meters and below. According to the agreement, code below 30-MHz still reigns. As an aside, the US Senate has yet to ratify the WARC treaty.

The no-code proposal has been floating around the commission for about 10 years, but contrary to some reports, the FCC harbors no immediate plans to drop the code requirement.

However, highly-placed FCC sources told us they favor a no-code ticket designed with VHF, UHF, and microwave experimenters in mind. It's not necessary, the thinking goes, for operators to understand International Morse just to tinker with the new technology. In fact, very little if any futuristic radio techniques will employ International Morse, and the FCC knows it. The commission still looks to hams as prime movers for expanding radio technology, and it doesn't want to hinder the state-of-the-art because someone can't master the dit-dahs.

Instead of the code, though, FCC officials say they would substitute a very difficult written test—with emphasis on the word "difficult." Even though commission officials seem to agree with this concept, it's still a long way off. If it were implemented tomorrow, it still couldn't take effect until 1982.

NEW PRODUCTS

AUTOMATIC ANTENNA TUNER

The Daiwa CNA-2002 marks a major advancement in antenna tuner technology with a compact, economical, and automatic 2.5-kW antenna tuner. The relatively small size of the CNA-2002 is made possible by a Daiwa breakthrough in high-voltage variable capacitor design. The large, old-style, variable capacitors have been replaced by small, rugged, encapsulated units. The CNA-2002 makes it possible to achieve an optimum antenna match in a minimum amount of time.

The matching function of the tuner becomes automatic whenever the operate button is pressed (5 to 50 Watts of rf must be applied to the tuner). The internal detection circuitry detects forward and reflected power and the resultant proportional dc voltage is applied to the motor control amplifier, which in turn drives the tuning motor. The tuning motor is connected to two variable tuning capacitors through a gear train using a 30:1 gear ratio. Automatic operation ceases when the swr dips below 1.5:1. Two fine-tuning controls on the right-hand side of the CNA-2002 can be used to quickly lower the swr to 1:1. The CNA-2002 performs its automatic tuning function in less than 45 seconds!

MCM's Automatic Antenna Tuner.

The tuner section of the unit can be switched out to permit the swr metering function to be used independently. The CNA-2002 incorporates the unique Daiwa cross-needle meter. It allows forward power, reflected power, and swr to be read simultaneously without sensitivity adjustments! The CNA-2002 also features a built-in 100-Watt dummy load, two switchable antenna outputs (SO-239 connec-

tors), and a linear amplifier remote-control terminal.

For more information, contact *MCM Communications, 858 E. Congress Park Dr., Centerville OH 45459; (513)-434-0031.* Reader Service number 486.

BEARCAT 100 HAND-HELD SYNTHESIZED SCANNER

Electra Company has announced a breakthrough in scanning radios with their new Bearcat® 100 hand-held portable, which they will manufacture here in the US. Fully synthesized, it requires no crystals. Compressed into a 3" × 7" × 1¼" case is more scanning power than many base or mobile units. The unit has a full 16 channels with extended frequency coverage. Power consumption is kept extremely low by using a liquid-crystal display and several low-power integrated circuits which are new to the industry.

The Bearcat 100 produces an audio power output of 500 milliwatts and a hefty one Watt when used in conjunction with the accessory ac adapter included in the package. The unit has patented Track Tuning, high selectivity, and sensitivity of less than a microvolt on all bands and all channels.

The unit operates on 6 AA batteries and has a battery-low LED indicator to signal when to recharge. A special internal circuit protects against overcharging while also preventing excess drain on the batteries. The unit's wide frequency coverage includes all public service bands (low, high, UHF, and "T" bands), both 2-meter and 70-centimeter amateur bands, plus military and federal land mobile frequencies. The unit has direct channel access and a built in automatic scan delay. The package includes a sturdy carrying case, earphone, and battery charger/ac adapter.

Complete details are available from Bearcat scanner suppliers, or by writing to *Electra Company, 300 East County Line Road, Cumberland IN 46229.* Reader Service number 480.

VOICE CONTROLLER

Remote control by voice via radio or telephone is now possible with the Covox Model I voice controller. Low in cost and fully self-contained, this noise- and click-resistant system extracts the voicing component of speech from low-grade voice communication circuits in the manner of a human listener.

The primary measure of voicing duration is modified and corrected through cross correlation, with vowel sounds characterized by the spoken words "dih" and "dah". Spoken Morse, binary, or RTTY codes are reliably recognized with considerable tolerance of the particular speaker and voice-channel quality.

A 16-word vocabulary controls anything that can be switched: garage doors, wheelchairs, etc. Use the fundamental pitch output for proportional control tasks, such as varying motor speed or dimming lights. Low power requirements make it ideal for portable systems using mobile, marine, aircraft, amateur, or CB radio.

The system is flexible, with applications to such diverse tasks as driving external vibrators for aiding the deaf through the sense of touch, or working in conjunction with a host computer to achieve a high degree of security in telephone or radio identification. The system comes complete with ac adapter, microphone, and user's manual. For more information, contact *Covox Company, PO Box 2342, Santa Maria CA 93455; (805)-937-9545 or 928-4818.* Reader Service number 483.

INSTANT-TUNING WEATHERADIO®

Radio Shack, a division of Tandy Corporation, has announced a new three-channel VHF-FM weather broadcast receiver. This latest addition to the company's line of Weatheradio® receivers features crystal control of tuning for instant station selection with a simple three-position switch, eliminating the problem of off-channel tuning and drift.

The crystal-controlled Weatheradio (12-152) receives NOAA/National Weather Service broadcasts on any of the three channels used: 162.550, 162.475, or 162.400 MHz. Because of the precise frequency selection possible with crystal control, stations can be accurately selected with a three-position switch instead of the usual manual tuning knob.

An rf amp brings in NOAA VHF weather stations at a range of up to 50 miles, making this receiver effective virtually anywhere in the United States.

The crystal-controlled Weatheradio is housed in a low-profile design with a simulated rosewood finish. It measures just 1-1/2" × 5-1/4" × 3-1/4" (H × W × D). The convenient top-mounted play-bar turns the unit on and off; the channel selector and volume control are hidden beneath the unit, since these settings are seldom changed in actual use. A 2-1/4" (diameter) speaker is top-mounted for excellent clarity.

Signals are captured by an attached antenna, which can be telescoped down and folded behind the unit for easy storage, if desired. Power is provided either from a 9-volt battery (not supplied) or an optional ac adapter (not included, available separately).

The Model 12-152 crystal-controlled Weatheradio and ac

Bearcat's hand-held synthesized scanner.

The Realistic crystal-controlled Weatheradio.

adapter are available at Radio Shack stores and participating dealers. Reader Service number 485.

DATAK FLEXY-MARKER

The Datak Corporation has developed a novel wiremarker. Called Flexy-Marker™, it is claimed to be the first major design improvement in 30 years.

The new marker breaks with tradition by using no cloth. It is made instead from a dead-soft vinyl plastisol film that clings and conforms to all wires. The adhesive adheres especially well to vinyl and will not loosen when the marker is flexed or exposed to heat and hydraulic and lubricating oils. The recommended upper temperature limit is 125° C, but when samples of the new marker were exposed continuously to 150° C, they showed no loosening and only a slight cosmetic discoloration.

While ordinary marker legends have a tendency to wear off when roughly handled, Flexy-Marker legends are heat-fused into the plastisol film so that they remain legible under the most severe working conditions. They are unaffected by most solvents and easily withstand the abrasion encountered from fishing wires through conduit and raceways.

If a standard wiremarker is hand-applied, it is difficult, if not impossible, to avoid contaminating the adhesive at the end of the marker. The result, after a few days, can be a loose or dangling marker. Flexy-Markers avoid this problem with a 3/8" tear-off tab that serves to both apply the marker and to seal down the end in one continuous motion. Flexy-Markers are perforated so that they can be used on one large diameter wire (0.35" diameter) or on a terminal strip and two smaller wires.

The new markers are supplied in sets of 24 identical sheets bound into a handy 3-1/4" × 5-1/2" pocket pad. The pads all contain a set of 1056 1- and 2-figure markers. The marker range initially includes identical and sequential numbers to 520 as well as the alphabet, supply-voltage designations, and miscellaneous machine-wiring designations. For more information, contact *The Datak Corporation, 65 71st Street, Guttenberg NJ 07093; (201)-869-2200.* Reader Service number 489.

MORSE-A-KEYER CW KEYBOARD

A low-cost, dependable CW keyboard is now available from Microcraft. It features an industrial-quality keyboard, a rugged steel case, and a 16-character first-in, first-out buffer which allows you to type slightly ahead of the text being sent. Also included are an internal speaker, a sidetone monitor, and a "buffer-full" LED warning.

The speed range is 5 to 45 wpm, standard, but can be easily increased by changing one resistor. A reed relay is used to key your transmitter and to provide isolation between the keyboard and associated equipment.

The Morse-A-Keyer is available as a partial kit, complete kit, or factory wired and tested. The partial kit consists of a PC board, construction manual, and board parts. The builder must supply an ASCII-coded keyboard, a 5-V at 120-mA supply, and miscellaneous hardware.

Shipments are made worldwide and requests for quotes are invited. Contact *Microcraft Corporation, PO Box 513, Thiensville WI 53092; (414)-241-8144.* Reader Service number 481.

TUBULAR PLYWOOD

Molded tubular plywood, a unique product with multiple uses, has recently been developed for industrial applications. Known as Plytube, it is a tough, versatile, and economical tubing, yet retains the warmth and beauty of natural wood. Stronger than steel, weight for weight, it is nonconductive, noncorrosive, waterproof, lightweight, and easy to cut and handle. In large diameters, it can be a low-cost replacement for fiberglass, metal, or plastic tubing.

Plytube is bonded under heat and high pressures with specially developed resins. This chemical impregnation gives the material unusual hardness and impermeability. It resists fungi, flame, and salt air and can be treated for underground installations. For special purposes, one or two of the wood plies can be replaced by metal, wire mesh, or synthetic laminates.

In the electronics field, Plytube offers unlimited uses. It is ideal for low-cost, easy-to-erect antenna masts. It can be used as coil forms for transformers, bobbins for coils, insulators, for lightweight housings, loudspeaker enclosures, and packaging of fragile or valuable instruments.

Plytube is available in any thickness from 3 to 46 plies and up to 84" in diameter. While circular in shape, it also can be formed in square, oval, and rectangular configurations. It can be extended to any length by internal or external sleeves. By using various types of wood and construction techniques, it can be adapted to a wide variety of weight and strength characteristics. For more information, write *Plytube Corporation of America, 39 S. Canal Street, Lawrence MA 01843.* Reader Service number 482.

The Microcraft Corporation Morse-A-Keyer.

TRAILERED TOWERS

Trailer-mounted antenna towers can be erected by a single person in record time as was

Molded tubular plywood from Plytube Corporation.

Indiana Quick Charge's QC500 charger.

recently demonstrated at Telex/Hy-Gain. From the time the trailer was parked to the full extension of the tower, only 15 minutes had passed. The company also demonstrated that these self-supporting crank-up steel towers are easily trailered even by passenger cars. According to the manufacturers, the trailer towers are exceptionally well suited to microwave tower surveys, their construction or repair, for site evaluation of repeaters, and for emergency field communications.

Towers are mounted on the trailer by a method which requires only one winch to tilt and erect the tower to its full height. Single-axle trailers, complete with legal running lights, accommodate medium to heavy-duty towers to 52 feet (15.85m). Two-axle, heavy-duty trailers with towers to 70 feet (21.3m) are also available.

For full information, contact Clyde Blyleven, *Hy-Gain, Division of Telex Communications, Inc., 8601 N. E. Highway Six, Lincoln NE 68505; (402)-467-5321.* Reader Service number 487.

INDIANA QUICK CHARGE QC500 CHARGER

Indiana Quick Charge, Inc., has announced the development of their newest product, the QC500 nicad fast charger. The QC500 is a combination home fast charger and mobile battery eliminator for nicad-powered portable hand-held transceivers.

The QC500 offers a quality constructed housing of die-cast metal that measures 2-1/2" × 4-1/4" × 1-1/4" and is covered with a gray baked-enamel finish that resists marring from constant use. Also featured are indicator lights that show input voltage, short-circuit condition, and output voltage, allowing the user to be assured of correct operation at a glance. Enclosed accessories include a UL-approved 1-Amp wall transformer (for home use), a mobile eliminator cord (which plugs into automobile cigarette lighter sockets), two replacement fuses, and a complete instruction manual. A warranty covers parts and service on the unit for a period of one year from date of purchase.

The QC500 is designed with heavy use and durability in mind. The charging unit is virtually indestructible physically and electrically. The unit can survive shorted output conditions and improper polarity connection. Both the input and output are fused to protect the charging unit and the user's equipment.

When used with the supplied wall transformer, the charger typically supplies 300 mA to the battery pack, gradually tapering down to 40 mA in about 4 hours. Extensive filtering of the charging current will allow normal operation with most equipment while the charging unit is in operation. When used with the mobile cigarette-lighter cord, the charging unit will allow operation of the user's radio equipment while in motion. Models are in stock for most popular hand-held units and the QC500 is readily adaptable to virtually any nicad-powered device with a 4- to 9-cell battery pack.

For more information, write *Indiana Quick Charge, Inc., 367 West Main Street, Danville IN 46122.* Reader Service number 488.

NEW HAMTRONICS® CATALOG

Hamtronics, Inc., has announced publication of a new expanded catalog crammed full of goodies for the VHF/UHF/OSCAR enthusiast.

The 40-page two-color catalog features a new 5-channel, 10-Watt VHF FM transceiver, new COR and CW ID modules for repeater builders, and new accessories, such as rf-tight enclosures for repeaters and power supplies. Also featured are the new T51 (VHF) and T451 (UHF) FM exciter modules. Many new ranges of transmitting and receiving converters have been added, as well as a series of receiving converters to extend the frequency coverage of scanners to new military, satellite, and commercial bands. The catalog also includes the full line of Cushcraft and Larsen VHF and UHF antennas.

For your free copy of this new catalog, write to *Hamtronics, Inc., 65F Moul Rd, Hilton NY 14468; (716)-392-9430.* (For overseas mailing, please send $2.00 or 5 IRCs.) Reader Service number 484.

SP-300 *from page 46*

sensors, and everything else are shielded from both each other and the outside world. Swr sensors? Yup. This meter has three, and they are switch-selectable from the front panel. Three different rigs and antennas can be connected to the meter at the same time. Each sensor has its own input and output connectors, and if there is any crosstalk between them, I couldn't detect it.

The first sensor covers 1.8 to 200 MHz, with a maximum power input of 200 Watts. The second covers the same frequency range, at a maximum level of 1 kW. These two sensors are fed with UHF connectors. The third sensor covers 130 to 500 MHz at a maximum of 150 Watts, and wonder of wonders, it's fitted with N-type connectors!

The SP-300 offers both relative and absolute power measurement using the procedures outlined earlier. Accuracy is rated at 10 percent, but should be much better than that under normal circumstances. Recalibration to a laboratory standard is possible, but as the instruction sheet says, "This SP-300 was perfectly tuned and adjusted by us, so don't try to remove the cover of this set and touch the inside." Cute.

I only found one thing on this meter to worry me, much less complain about. There are three LEDs on the front panel to indicate which sensor is in use. Other meters using the same scheme have had some problems with the LEDs rectifying the signal, causing radiation of harmonics. I didn't experience this unwelcome phenomenon, but if you should, or if you want to be careful, it is a simple matter to clip the LEDs out of the circuit.

All things considered, this is a surperb piece of equipment that outclasses most of the competition in looks, features, and performance. It isn't cheap, but what is these days? For further information, contact *NCG Company, 1275 N. Grove Street, Anaheim CA 92806,* and pray he has a few left. Enjoy! Reader Service number 479.■

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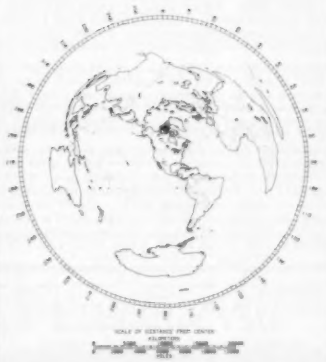

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ANT-2 Disks and spacers for 32 element, 22db gain antenna. $20.00

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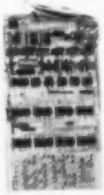

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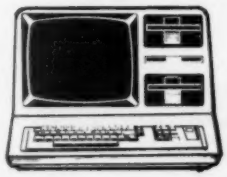

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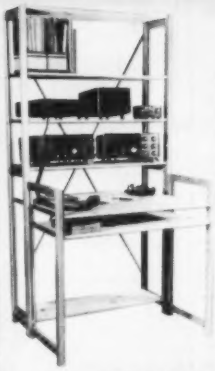

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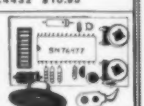

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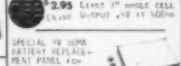

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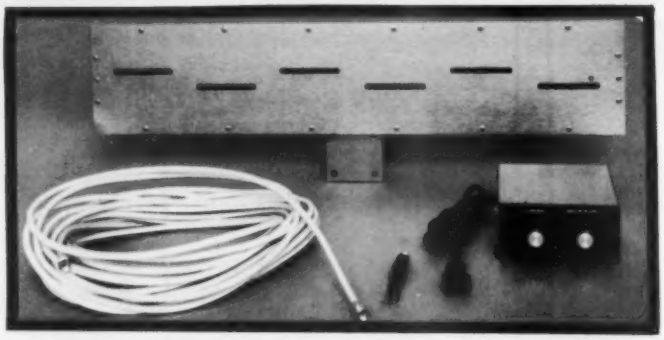

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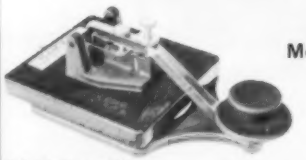

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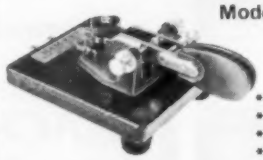

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OSCAR ORBITS

Courtesy of AMSAT

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at ~5°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

● IMPORTANT NOTE: At press time, it appears that OSCAR 7 has finally expired after more than six years of service. We continue to publish the orbital parameters, based on the slim hope that the satellite can be brought back to life. For further details on the demise of OSCAR 7, see "Death of a Satellite" on page 97.

OSCAR 7 ORBITAL INFORMATION FOR SEPTEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
31086	1	0053:39	94.0
31099	2	0147:53	108.4
31111	3	0047:10	93.3
31124	4	0141:24	106.9
31136	5	0040:41	91.7
31149	6	0134:55	105.3
31161	7	0034:12	90.1
31174	8	0128:26	103.7
31186	9	0027:43	88.6
31199	10	0121:57	102.2
31211	11	0021:14	87.0
31224	12	0115:28	100.6
31236	13	0014:45	85.4
31249	14	0108:59	99.0
31261	15	0008:16	83.9
31274	16	0102:30	97.4
31286	17	0001:47	82.3
31299	18	0056:01	95.9
31312	19	0150:15	109.5
31324	20	0049:32	94.3
31337	21	0143:46	107.9
31349	22	0043:03	92.7
31362	23	0137:16	106.3
31374	24	0036:34	91.2
31387	25	0130:47	104.8
31399	26	0030:05	89.6
31412	27	0124:18	103.2
31424	28	0023:36	88.0
31437	29	0117:49	101.6
31449	30	0017:06	86.5

OSCAR 8 ORBITAL INFORMATION FOR SEPTEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
17793	1	0103:11	79.4
17807	2	0107:44	80.5
17821	3	0112:17	81.7
17835	4	0116:50	82.9
17849	5	0121:22	84.0
17863	6	0125:55	85.2
17877	7	0130:28	86.4
17891	8	0135:01	87.5
17905	9	0139:33	88.7
17918	10	0099:55	64.1
17932	11	0095:27	65.2
17946	12	0010:00	66.4
17960	13	0014:32	67.6
17974	14	0019:05	68.7
17988	15	0023:37	69.9
18002	16	0028:09	71.1
18016	17	0032:41	72.2
18030	18	0037:13	73.4
18044	19	0041:45	74.6
18058	20	0046:17	75.7
18072	21	0050:49	76.9
18086	22	0055:21	78.0
18100	23	0059:53	79.2
18114	24	0104:24	80.4
18128	25	0108:56	81.5
18142	26	0113:28	82.7
18156	27	0117:59	83.9
18170	28	0122:30	85.0
18184	29	0127:02	86.2
18198	30	0131:33	87.3

OSCAR 7 ORBITAL INFORMATION FOR OCTOBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
31462	1	0111:20	100.1
31474	2	0010:37	84.9
31487	3	0104:51	98.5
31499	4	0004:08	83.3
31512	5	0058:22	96.9
31525	6	0152:35	110.5
31537	7	0051:53	95.3
31550	8	0146:06	108.9
31562	9	0045:23	93.8
31575	10	0139:37	107.4
31587	11	0038:54	92.2
31600	12	0133:08	105.8
31612	13	0032:25	90.6
31625	14	0126:39	104.2
31637	15	0025:56	89.1
31650	16	0120:09	102.7
31662	17	0019:27	87.5
31675	18	0113:40	101.1
31687	19	0012:57	85.9
31700	20	0107:11	99.5
31712	21	0006:28	84.4
31725	22	0100:42	97.9
31738	23	0154:55	111.5
31750	24	0054:12	96.4
31763	25	0148:26	110.0
31775	26	0047:43	94.8
31788	27	0141:57	108.4
31800	28	0041:14	93.2
31813	29	0135:27	106.8
31825	30	0034:44	91.7
31838	31	0128:58	105.3

OSCAR 8 ORBITAL INFORMATION FOR OCTOBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
18212	1	0136:04	88.5
18226	2	0140:36	89.7
18239	3	0091:56	65.0
18253	4	0096:27	66.2
18267	5	0010:58	67.4
18281	6	0015:29	68.5
18295	7	0020:00	69.7
18309	8	0024:31	70.8
18323	9	0029:02	72.0
18337	10	0033:32	73.2
18351	11	0038:03	74.3
18365	12	0042:34	75.5
18379	13	0047:04	76.6
18393	14	0051:35	77.8
18407	15	0056:05	78.9
18421	16	0100:35	80.1
18435	17	0105:06	81.3
18449	18	0109:36	82.4
18463	19	0114:06	83.6
18477	20	0118:36	84.7
18491	21	0123:06	85.9
18505	22	0127:36	87.0
18519	23	0132:06	88.2
18533	24	0136:36	89.4
18547	25	0141:06	90.5
18560	26	0082:25	65.9
18574	27	0086:54	67.0
18588	28	0011:24	68.2
18602	29	0015:54	69.3
18616	30	0020:23	70.5
18630	31	0024:53	71.6

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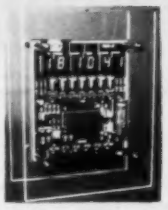

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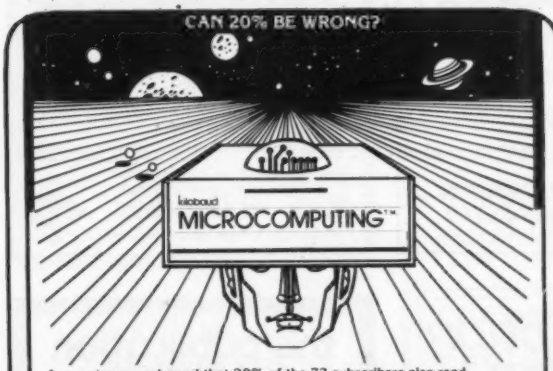

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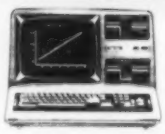

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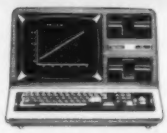

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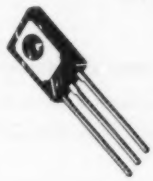

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74174N	.86	LM1309	1.27	CD4560	1.62	D50026CN	3.75	2.4576 MHz	4.00
74175N	.65	LM1837	2.00	CD4527	1.51	D50050CN	3.75	3.2768 MHz	4.50
74190N	1.15	LM1310	2.75	CD4528	1.50	MM53104	2.50	5.0688 MHz	4.50
74193N	.87	LM1889	3.00	CD4529	1.50			5.185 MHz	4.00
74193N	.65	LM1812	7.50	CD4586	2.45	**MICROPROCESSOR**		5.7143 MHz	4.50
74221N	1.25	LM1889	2.00	CD4583	1.00	6502	10.95	6.5536 MHz	4.00
74298N	.95	LM1871	2.50	CD4585	1.10	6504	9.95	7.1.31818 MHz	4.00
74365N	.75	LM1900	2.25	CD40192	3.60	6521	9.95	18.432 MHz	4.50
74366N	.75	LM3900N	.50	74C00	.75	6522	9.95	22.1184 MHz	4.50
74367N	.75	LM3905	1.75	74C04	.49	6809	9.95		
		LM3909N	.95	74C10	.49	6800	11.95	**KEYBOARD ENCODERS**	
74L500 TTL		MC14539P	1.50	74C14	.69	6802	4.95	AY5-2376	$12.50
74L500N	29	NE555N	1.35	74C20	.35	6808	5.95	AY5-3600	17.50
74L502N	29	NE556	.75	74C30	.35	6809A	5.95	AY5-8189	9.00
74L504N	35	NE558A	.65	74C48	1.00	6845	12.95	AY5-6200	16.50
74L508N	29	NE560A	1.10	74C73	.75	74C922	5.00	74C923	5.00
74L509N	35	NE561V	1.50	74C75	.75	7301A	11.95	74C923	5.95
74L510N	35	NE567V	1.00	74C90	1.25	8212	2.90	HD0165-5	6.95
74L513N	53	NE570N	4.00	74C93	1.25	8214	5.50	AY5-8600	16.00
74L514N	1.00	78L05	.68	74C154	3.50	8216	2.98		
74L518N	.70	78M05	.85	74C157	1.00	8224	4.43	**D Connectors RS232**	
74L522N	.35	78M05	.85	74C175	1.35	8228	4.95	DB25P	3.00
74L526N	.35	75108	1.75	74C192	1.60	8251	6.95	DB25S	3.50
74L530N	.35	75110A	.75	74C221	.95	8253	14.95	Cover	1.00
74L533N	.60	75492CN	.50	74C895	6.00	8255	5.75	DE9P	1.98
74L537N	.50	75494CN	.50	74C899	6.00	8257	14.95	DE9S	2.10
74L547N	.45			74C914	1.55	8259	14.95	DA15S	3.10
74L575N	.65			74C922	5.00	8502DP plus	13.95	Complete Set	7.50
74L576N	.65	**A to D CONVERTER**		74C923	5.00	8602DP plus	17.95		
74L593N	.75	8038E	4.50	74C925	7.50	8619	9.50	**Hicash 3½ Digit LED mod-**	
74L595N	1.00	ADC0804CD	10.95	74C926	7.50	8620	9.50	**ule kit $9.95**	
74L617N	.40	8701CN	22.00	74C927	6.95	CDP1802D	35.00	**Stopwatch Kit 26.95**	
74L622N	.45	8701CJ	13.00			CDP1610D	7.95	**Basic Clock Kit 17.95**	
74L623N	.45	8703CJ	14.25	**INTERFACE**		**Digital Clock Kit 19.75**			
74L673N	.80			8095	.65	**UART/USYO**			
74L674N	.80	8488/CJ-V-F	7.40	8097	.65	AY5-1013	5.50	**8S-108 Epson Kit**	
74L685N	.80	9400CJ	9.50	8098	.65	AY5-1014	7.50	(less PROMS) $80.00	
74L715N	.75	ICL7107	14.25	8097	.65	3341	6.95	**Motherboard $35.00**	
74L155N	.75			8095	.65			**Extender Board $15.00**	
74L518N	.80	**CMOS**		8224	1.25				
74C152N	1.10	CD4000	.25	8110	5.50	**PROM**		**RESISTORS** ¼ watt 5%	
74C154N	1.10	CD4001	.35	8113	5.50	1702A	4.50	10 per type .03	
74C174N	1.15	CD4002	.35	8720	5.50	2513	19.50	100 per type .02	
74C190N	1.25	CD4007	.25	8723	5.50	2708	4.70	1000 per type .012	
74C221N	1.25	CD4008	.65	8726	5.50	2716	6.50	5000 piece price	
74C526N	1.00	CD4009	1.20	8728	3.20	2716 5 Volt	6.50	5 per type 6.75	
74L597N	.80	CD4010	.49	8729	3.20	5-2716 5 Volt	46.00	½ watt 5% per type .05	
		CD4011	.25	8741	2.75	2732	7.95		
LINEAR		CD4012	.25	8795	1.49	2758	14.00		
LA3045	.90	CD4013	.49			2764	14.00		
LA3046	1.10	CD4013	.49			2716A	6.50		
LA3065	1.10	CD4014	1.25	**MOS/MEMORY**		6749	55.00	**DIP Switches**	
LA3082	1.80	CD4015	1.50	**RAM**		6749-0	55.00	4-position $ .95 7-position 1.60	
LA3083	1.80	CD4016	.55	2101-1	2.95	6756A	55.00	5-position 1.00 8-position 1.85	
MA3014/MA1	.70	CD4017	1.65	2102-1	.95	N82S23	2.95	6-position 1.00	
LM309H	.87	CD4018	.94	2102AL-4	1.45	N82S123	4.75		
LM309K	1.00	CD4019	.45	2102BA-2L	.95	N82S129	4.75		
LM309N	1.00	CD4020	1.65	2104A-4	4.95	N82S131	4.95		
LM309T	.75	CD4021	1.65	2107B-4	4.95	N82S131	4.95		
LM311N/N	.39	CD4022	1.10	2111-1	3.75	N82S136	6.75		
LM317T	1.65	CD4023	.29	2112-2	3.95	N82S137	7.75		
LM317K	3.75	CD4024	.49	2114	2.95	0466/77	2.00		
LM318	1.50	CD4025	.29	2114L 300ns	4.25	6223	3.50		

4116 200ns Dynamic RAM
8/$18.40

KEYBOARDS

56 key ASCII keyboard kit	$67.50
Fully assembled	77.50
53 key ASCII keyboard kit	69.00
Fully assembled	79.00
Enclosure Plastic	14.95
Metal Enclosure	29.95

LEDS

Red T010	15
Green, Yellow T010	20
Jumbo Red	30
Green, Orange, Yellow Jumbo	35
Clipsite LED Mounting Clips	$.5/1.25
Lens(hi red, amber, green, yellow, clear)	.30

CONTINENTAL SPECIALTIES in stock
Complete line of breadboard test equip
MAX-100 8 digit Freq. Ctr. $149.95

QK WIRE WRAP TOOLS in stock
Portable Multimeter $10.00
Complete line of AP Products in stock.

SPECIAL PRODUCTS

MM5405 Stopwatch Timer with 10 pp spec	9.00
PC board	7.50
Switches Mom. Pushbutton	.27
3 pos. slide	.25
Encoder HD0165-5	6.95
Perotronics	
Model 10 Trigger Expander Kit	$229.00
Model 150 Box Grabber Kit	$369.00
Clock Calendar Kit	**$83.95**
2.5 MHz Frequency Counter Kit	**$37.50**
50 MHz Frequency Counter Kit	**$67.75**

TRANSFORMERS

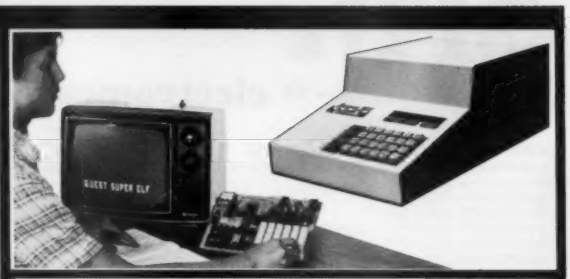
6V 300 ma	2.25
12 Volt 2 amp wall plug	7.95
12.6 CT 2 amp	5.95
12.6 CT 4 amp	9.45
12.6 CT 8 amp	12.45
12 6V CT 600 ma	3.75
12V 250 ma wall plug	2.95
12V CT 250 ma wall plug	3.75
24V CT 100 ma	3.95
16V 1.2 amp wall plug	4.65
12V 6 amp	12.95
12V 500 ma wall plug	4.75
12V 1 amp wall plug	6.50
10.15 VAC 6.15 VA wall plug	9.75

DISPLAY LEDS

MAN1	CA	.270	2.99
MAN3	CC	.125	.39
MAN72/74	CA/CA	.300	1.69
DL704	CC	.300	1.25
DL707/DL707R	CA	.300	1.69
DL727-728	CA/CC	.500	1.99
DL747-750	CA/CC	.600	1.99
FND359	CC	.357	.79
FND500-507	CC/CA	.500	1.35
FND503-510	CA	.500	.99
FND800-807	CC/CA	.800	2.20
3 digit Bubble			.69
10 digit display			1.25
7529 Clares photocells			.99
TIL311 Hex			9.50
MAN3640	CC	.30	1.10
MAN6610	CA	.40	1.29
MAN4640	CC	.40	1.29
MAN4710	CA	.40	.95
MAN7440	CC	.40	1.29
MAN8640	CC	.56	2.95
MAN8710	CC	.80	1.95
MAN8740	CC	.80	1.35

MA1088A, C, G	**9.95**
MA1012A	**9.95**
1027/3 transformer	**2.25**
MA1012A Transformer	**2.75**

Televideo Terminal
Model 912 $795.00
Model 920 $885.00



RCA Cosmac 1802 Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded** with **additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

Before you buy another small computer, see if it includes the following features: ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Real cost of in warranty repairs; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step.** Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** All metal Expansion Cabinet, painted and silk screened, with room for 5 S-100 boards and power supply **$57.00. NiCad Battery Memory Saver Kit $5.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for $12.00 per 12 issues. Single issues $1.50. Issues 1-12 bound $16.50.

Free 14 page brochure. of complete Super Elf system.

Moews Video Graphics **$3.50.** Games and Music **$3.00,** Chip 8 Interpreter **$5.50.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50. A 50 pin connector set** with ribbon cable is available at $15.25 for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply).

Quest Super Basic V5.0

A new enhanced version of **Super Basic** now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic** by **Ron Cooke**r including floating point capability with scientific notation (number range $\pm .17E^{38}$), 32 bit integer ± 2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs; and over 75 statements, functions and operations.

New improved faster version including **renumber** and essentially **unlimited variables.** Also, an exclusive user expandable command library.

Serial and Parallel I/O included.

Super Basic on Cassette $55.00.

Type-N-Talk by Votrax

Text to speech synthesizer with unlimited vocabulary, built-in text to speech algorithm, 70 to 100 bits per second speech synthesizer, RS232C interface $345.00.

1802 16K Dynamic RAM Kit $149.00

Expandable to 64K. Hidden refresh w/clocks up to 4 MHz w/no wait states. Addl. 16K RAM **$25.00**
Tiny Basic Extended on Cassette $15.00
(Added commands include Stringy, Array, Cassette I/O etc.) S-100 4-slot expansion $ 9.95
Super Monitor V1.1 Source Listing $15.00

Elf II Adapter Kit $24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00.**

Super Color S-100 Video Kit $129.95

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80 etc.
Dealers: Send for excellent pricing/margin program.

Editor Assembler $25.00
(Requires minimum of 4K for E/A plus user source)
1802 Tiny Basic Source listing $19.00
Super Monitor V2.0/2.1 Source Listing $20.00

PROM Eraser

assembled. 25 PROM capacity **$37.50** (with timer **$69.50**). 6 PROM capacity OSHA/UL version **$78.50** (with timer **$108.50**).

Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Bare Board **$28.50.** Full Kit **$99.00.** Monitor **$20.00.** Power Supply Kit **$35.00. Tiny Basic $30.00**

S-100 Computer Boards

8K Static Godbout Econo IIA Kit	149.00
16K Static Godbout Econo XIV Kit	269.00
24K Static Godbout Econo XX-24 Kit	414.00
32K Static Godbout Econo XX-32 Kit	537.00
16K Dynamic RAM Kit	289.00
32K Dynamic RAM Kit	328.00
64K Dynamic RAM Kit	399.00
Video Interface Kit	**$161.00**
Color Video Kit	129.95

81 IC Update Master Manual $79.95

Comp. IC data selector, 2 vol. master reference guide. Over 51,000 cross references. Free update service through 1981. Domestic postage $4.75.

Modem Kit $60.00

State of the art, orig., answer. No tuning necessary. 103 compatible 300 baud. Inexpensive acoustic coupler plans included. Bd. Only $17.00. Article in June *Radio Electronics*.

Gremlin Color Video Kit $69.95

32 x 16 alpha/numerics and graphics, up to 8 colors with 6847 chip; 1K RAM at E000. Plugs into Super Elf 44 pin bus. No high res. graphics. On board RF Modulator Kit **$4.95**

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$9.95**

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer, 20 char. alphanumeric display, ROM monitor, fully expandable. **$405.00.** 4K version **$450.00.** 4K Assembler **$85.00.** 8K Basic Interpreter **$100.00**

Special small power supply for AIM65 assem. in frame **$54.00.** Complete AIM65 in thin briefcase with power supply **$499.00.** Molded plastic enclosure to fit both AIM65 and power supply **$47.50.** Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$625.00.**

AIM65/KIM/VIM/Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95.**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

Video Modulator Kit $9.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Multi-volt Computer Power Supply

8v 5 amp, ±16v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12v option. ±5v, ±12v are regulated. Basic Kit **$35.95.** Kit with chassis and all hardware **$51.95.** Add $5.00 shipping. Kit of hardware **$16.00.** Woodgrain case **$10.00.** $1.50 shipping.

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax. $10.00 min. BankAmericard and Master Charge accepted. $1.00 insurance optional. Postage: Add 5%. C.O.D. $10.00 min. order.

FREE: Send for your copy of our NEW 1981 QUEST CATALOG. Include 48¢ stamp.

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PARTS WAREHOUSE

We now have available a bunch of goodies too good to bypass. Items are limited so order today.

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Penfield, NY 14526
716-586-3950

Call Your Phone Order In Today

TERMS: Satisfaction guaranteed or money refunded. C.O.D. add $2.00. Minimum order $6.00. Orders under $10.00 add $1.50. Add 5% for postage, insurance, handling. Overseas add 15%. N.Y. residents add 7% tax.

MINI KITS - YOU HAVE SEEN THESE BEFORE NOW HERE ARE OLD FAVORITE AND NEW ONES TOO. GREAT FOR THAT AFTERNOON HOBBY.

FM MINI MIKE

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit **$14.95**
FM-3 Wired and Tested **19.95**

Color Organ

See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110 VAC.

Complete kit, ML-1 **$8.95**

Video Modulator Kit

Converts any TV to video monitor. Super stable, tunable over ch. 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market! Complete kit, VD-1 **$7.95**

Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts. Complete kit, BL-1 **$2.95**

Super Sleuth

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker. Complete kit, BN-9 **$5.95**

CPO-1

Runs on 3-12 Vdc 1 wall out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit **$2.95**

FM Wireless Mike Kit

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit **$3.95** FM-2 kit **$4.95**

Whisper Light Kit

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC. Complete kit, WL-1 **$6.95**

Tone Decoder

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts. Complete kit, TD-1 **$5.95**

Universal Timer Kit

Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit **$5.95**

Mad Blaster Kit

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC

MB-1 Kit **$4.95**

Siren Kit

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker. Complete kit, SM-3 **$2.95**

60 Hz Time Base

Runs on 5-15 VDC. Low current (2.5ma) 1 min/month accuracy TB-7 Kit **$5.50**
TB-7 Assy **$3.95**

CLOCK KITS

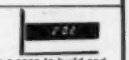
Your old favorites are here again. Over 7,000 Sold to Date. Be one of the gang and order yours today!

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, black (specify).

Clock kit, 12/24 hour, DC-5 **$24.95**
Clock with 10 min. ID timer, 12/24 hour, DC-10 **$29.95**
Alarm clock, 12 hour only, DC-8 **$29.95**
12V DC car clock, DC-7 **$29.95**

For wired and tested clocks add $10.00 to kit price.
SPECIFY 12 OR 24 HOUR FORMAT

Car Clock



The UN-KIT, only 5 solder connections

Here's a super looking, rugged and accurate auto clock, which is a snap to build and install. Clock movement is completely assembled — you only solder 3 wires and 2 switches, takes about 15 minutes! Display is bright green with automatic brightness control photocell — assures you of a highly readable display, day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify)

DC-3 kit, 12 hour format **$22.95**
DC-3 wired and tested **$29.95**

Calendar Alarm Clock

The clock that's got it all: 6- 5" LEDs, 12/24 hour, snooze, 24 hour alarm, 4 year calendar, battery backup, and lots more. The super 7001 chip is used. Size: 5x4x2 inches. Complete kit, less case (not available) DC-9 **$34.95**

Under Dash Car Clock

12/24 hour clock in a beautiful plastic case features 6 jumbo RED LEDS, high accuracy (.001%), easy 3 wire hookup, display blanks with ignition, and super instructions. Optional dimmer atuomatically adjusts display to ambient light level

DC-11 clock with mtg. bracket **$27.95 kit**
DM-1 dimmer adapter **$2.50**
Add $10.00 Assy. and Test

Video Terminal

A completely self-contained stand alone video terminal card. Requires only an ASCII keyboard and TV set to become a complete terminal unit. Features are: single 5V supply, XTAL controlled sync and baud rates (to 9600), complete computer and keyboard control of cursor. Parity error control and display. Accepts and generates serial ASCII plus parallel keyboard input. The 6416 is 64 char. by 16 lines with scrolling, upper and lower case (optional) and has RS-232 and 20ma loop interfaces on board. Kits include sockets and complete documentation.

RE 6416 terminal card kit (add $60.00 for wired unit) **$189.95**
Lower Case option **$13.95**
Power Supply **$14.95**
RF Modulator kit **$7.95**

PARTS PARADE

IC SPECIALS

LINEAR

301	$ .35
324	$1.50
380	$1.50
555	$ .45
556	$1.00
565	$1.00
566	$1.00
567	$1.25
741	10/$2.00
1458	$ .50
3900	$ .59
3914	$2.95
8038	$2.95

TTL

74S00	$ .40
7447	$ .65
7475	$ .50
7490	$ .50
74196	$1.35

SPECIAL

11C90	$15.00
10116	$ 1.25
7208	$17.50
7207A	$ 5.50
7216D	$21.00
7107C	$12.50
5314	$ 2.95
5375AB/G	$ 2.95
7001	$ 6.50

CMOS

4011	.50
4013	.50
4046	$1.85
4049	.50
4059	$9.00
4511	$2.00
4518	$1.35
5639	$1.75

FERRITE BEADS

With info and specs. 15/$1.00
6 Hole Balun Beads 5/$1.00

READOUTS

FND 359 .4" C.C.	$1.00
FND 507/510 .5" C.A.	1.00
MAN 72/HP7730 .33" C.A.	1.00
HP 7851 .43" C.A.	2.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

TRANSISTORS

2N3904 NPN C+F	15/$1.00
2N3906 PNP C+F	15/$1.00
2N4403 PNP C+F	15/$1.00
2N4410 NPN C+F	15/$1.00
2N4916 FET C+F	4/$1.00
2N5401 PNP C+F	5/$1.00
2N6028 C+F	4/$1.00
2N3771 NPN Silicon	$1.50
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/$1.00
MPF 102/2N5484	3.50
NPN 3904 Type T+R	50/$2.50
PNP 3906 Type T+R	50/$2.50
2N3055	5.00
2N2646 UJT	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP 100V Bridge **$1.50 each**

Mini-Bridge 50V 1 AMP 2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting, ½" center, ½" leads, bag of 300 or more. **$1.50**

Switches

Mini toggle SPDT **$1.00**
Red Pushbuttons N.O. **3/$1.00**

Earphones

3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc. 5 for $1.00

Mini 8 ohm Speaker

Approx 2¼" diam. Round type for radios, mike etc **3 for $2.00**

Slug Tuned Coils

Small 3/16" Hex. Slugs turned coil. 3 turns. 10 for $1.00

Solid State Buzzers

small buzzer 450 Hz. 86 dB sound output on 5-12 vdc at 10-30 mA. TTL compatible. **$1.50**

AC Outlet

Panel Mount with Leads **4/$1.00**

CAPACITORS

TANTALUM Dipped Epoxy	ALUMINUM Electrolytic		DISK CERAMIC	
1.5 uF 25V 3/$1.00	1000 uF 16V Radial	$.50	.01 16V disk	20/$1.00
1.8 uF 25V 3/$1.00	500 uF 20V Axial	$.50	.001 16V	20/$1.00
.22 uF 25V 3/$1.00	150 uF 16V Axial	5/$1.00	100 pF	30/$1.00
	10 uF 15V Radial	10/$1.00	.047 16V	20/$1.00

DC-DC Converter

+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma **$1.25**

Crystals

3.579545	MHZ	$1.50
10.00000	MHZ	$5.00
5.248800	MHZ	$5.00

AC Adapters

Good for clocks, nicad chargers, all 110 VAC plug one end

6.5 vdc @ 20 mA	$1.00
16 vac @ 160mA	$2.50
12 vac @ 250mA	$3.00

Ceramic IF Filters

Mini ceramic filters 7 kHz B.W. 455 kHz $1.50 ea.

Trimmer Caps

Sprague - 3-40 pf Stable Polypropylene .50 ea.

25K 20 Turn Trim Pot **$1.00**
1K 20 Turn Trim Pot **.50**

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge **$.75**

Mini RG-174 Coax

10 ft. for $1.00

Coax Connector

Chassis mount BNC type **$1.00**

9 Volt Battery Clips

Nice quality clips **5 for $1.00**
¼" Rubber Grommets **10 for $1.00**

Parts Bag

Asst. of chokes, disc caps, tant., resistors, transistors, diodes, MICA caps etc
sm. bag (100 pc) **$1.00** lg. bag (300 pc) **$2.50**

Connectors

6 pin type gold contacts for mA-1003 car clock module price .75 ea.

Leds - your choice, please specify

Mini Red, Jumbo Red, High Intensity Red, Illuminator Red **8/$1**
Mini Yellow, Jumbo Yellow, Jumbo Green **6/$1**

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - .50 each or 3/$1.00

Audio Prescaler

Make high resolution audio measurements, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit **$29.95**
PS-2 wired **$39.95**

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity. specify - 10 or -100

Wired, tested, PS-1B **$59.95**
Kit, PS-1B **$44.95**

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit **$22.95**
TR-1, RF sensed T-R relay kit **6.95**

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz **$11.95**

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay TR-1 Kit **$6.95**

Power Supply Kit

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5 at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3 V @ 1 A and 24 VCT.

Complete kit, PS-3LT **$6.95**

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 compatible, but 500,000 MEG input z, super low 50 pa input current, low power drain.

50 for only $9.00 **10 for $2.00**

Regulators

78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size: 1" x ¼" shrink to ¼". Great for splices. **50/$1.00**

Mini TO-92 Heat Sinks

Thermalloy Brand **5 for $1.00**
To-220 Heat Sinks **3 for $1.00**

Opto Isolators - 4N28 type **$.50 ea.**

Opto Reflectors - Photo diode + LED **$1.00 ea.**

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. **20 strips for $1.00**

CDS Photocells

Resistance varies with light, 250 ohms to over 3 meg **3 for $1.00**

See List of Advertisers on page 114

SEMICONDUCTORS SURPLUS

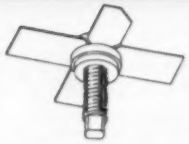
ARCO CAPS

304	100-550pF	1.50	469	170-780pF	1.40
400	.9-7pF	1.00	4615	390-1400pF	2.02
402	1.5-20pF	1.00	404	8-60pF	1.00
420	1-12pF	1.00	405	10-80pF	1.00
423	7-100pF	1.00	422	4-40pF	1.00
426	37-250pF	1.01	424	16-150pF	1.00
464	25-280pF	1.00	427	55-300pF	1.00
465	50-380pF	1.39	462	5-80pF	1.50
467	110-580pF	1.03			

TUBES

6KD6	5.00	6939	7.99
6LQ6/6JE6	6.00	6146	5.00
6MJ6/6LQ6/6JE6C	6.00	6146A	5.69
6LF6/6MH6	5.00	6146B/8298	7.95
12BY7A	4.00	6146W	12.00
2E26	4.69	6550A	8.00
4X150A	29.99	8908	9.00
4CX250B	45.00	8950	9.00
4CX250R	69.00	4-400A	145.00
4CX300A	109.99	4-400C	145.00
4CX350A/8321	100.00	572B/T160L	44.00
4CX350F/J/8904	100.00	7289	9.95
4CX1500B/8660	300.00	3-1000Z	229.00
811A	20.00	3-500Z	141.00
6360	4.69		

RF Transistors



MRF203	P.O.R.	MRF449	12.65	BFR91	1.25
MRF216	19.47	MRF449A	12.65	BFR96	1.50
MRF221	8.73	MRF450	11.00	BFW92A	1.00
MRF226	10.20	MRF450A	11.77	BFW92	.79
MRF227	2.13	MRF452	15.00	MMCM918	14.30
MRF238	10.00	MRF453	13.72	MMCM2222	15.65
MRF240	14.62	MRF454A	21.83	MMCM2369	15.00
MRF245	28.87	MRF455	14.08	MMCM2484	15.25
MRF247	28.87	MRF455A	14.08	MMCM3960A	24.30
MRF262	6.25	MRF474	3.00	MWA120	7.80
MRF314	12.20	MRF475	2.90	MWA130	8.08
MRF406	11.33	MRF476	2.25	MWA210	7.46
MRF412	20.65	MRF477	10.00	MWA220	8.08
MRF421	27.45	MRF485	3.00	MWA230	8.62
MRF422A	38.25	MRF492	20.40	MWA310	8.08
MRF422	38.25	MRF502	.93		
MRF428	38.25	MRF604	2.00	NEW MRF472	
MRF428A	38.25	MRF629	3.00	12.5 VDC, 27 MHz	
MRF426	8.87	MRF648	26.87	4 Watts output	
MRF426A	8.87	MRF901	3.99	10 dB gain	
		MRF902	9.41	1.69 ea.	
		MRF904	3.00	10/9.50	
		MRF911	4.29	100/69.00	
		MRF5176	11.73	1000/480.00	
		MRF8004	1.39		
		BFR90	1.00		

TO-3 TRANSISTOR SOCKETS
Phenolic type..... 6/$1.00

NEW SIMPSON 260-7 $99.99

RG174/U - $15.00 per 100 ft.
Factory new

PL259 TERMINATION
52 Ohm 5 Watts $1.50 each

TORIN TA700 FANS NEW $29.99 each
Model A30340
230 VAC @ .78 Amps
Will also work on 115 VAC

CRYSTAL FILTERS

EFCL455K13E	3.99
EFCL455K40B2	2.99
FX-07800L, 7.8 MHz	12.99
FHA103-4, 10.7 MHz	12.99

CB type crystals

$4.95 each

51-T		
T1	T15	T28
T2	T16	T29
T3	T17	T30
T4	T18	T31
T5	T19	T32
T6	T20	T33
T7	T21	T34
T8	T22	T35
T9	T23	T36
T10	T24	T37
T11	T25	T38
T12	T26	T39
T13	T27	T40
T14		

51-R		
R1	R15	R28
R2	R16	R29
R3	R17	R30
R4	R18	R31
R5	R19	R32
R6	R20	R33
R7	R21	R34
R8	R22	R35
R9	R23	R36
R10	R24	R37
R11	R25	R38
R12	R26	R39
R13	R27	R40
R14		

NEW CHERRY BCD SWITCH
New end plates
Type T-20..... 1.29 each

Johnson AIR Variables

$1.00 each

T-3-5	1 to 5 pF
T-6-5	1.7 to 11 pF
T-9-5	2 to 15 pF
189-6-1	.1 to 10 pF
189-502-Y	1.3 to 6.7pF
189-503-105	1.4 to 9.2pF
189-504-5	1.5 to 11.6pF
189-505-5	1.7 to 14.1pF
189-505-107	1.7 to 14.1pF
189-506-103	1.8 to 16.7pF
189-507-105	2 to 19.3pF
189-508-5	2.1 to 22.9pF
189-509-5	2.4 to 24.5pF
545-043	1.8 to 11.4pF

Johnson AIR Variables

1/4 x 2 1/2" shaft
$2.50 each

193-10-6	2.2 to 34 pF
193-	1.5 to 27.5pF
193-	.6 to 6.4pF

$1.00 each

160-107-16	.5 to 12 pF
193-10-9	2.2 to 34 pF
193-10-104	2.2 to 34 pF
193-4-5	3 to 30 pF

RF Power Device

MRF454 Same as MRF458
12.5 VDC, 3-30 MHz
80Watts output, 12dB gain
$17.95 ea.

E.F. JOHNSON TUBE SOCKETS

#124-0311-100..... 6.99 each
For 8072 etc.

#124-0107-001..... 13.99 each
For 4CX250B/R, 4X150A etc.

#124-0111-001..... 4.99 each
Chimney for 4CX250B/R and 4X150

#124-0113-001 and 124-0113-021
$12.99 each
Capacitor for #124-0107-001

#123-209-33 Sockets....6.99 each
For 811A, 572B, 866, etc.

UNELCO CAPS

MIN. ORDER $10

6.8pF	47pF	
8.2pF	62pF	
10pF	100pF	
12pF	160pF	
13pF	180pF	
14pF	200pF	
20pF	240pF	
24pF	380pF	
33pF	470pF	
36pF	1000pF	
43pF	350V	$1.00 each

86 Pin Motorola Bus Edge Connectors

Gold plated contacts
Dual 43/86 pin .156 spacing
Soldertail for PCB.....$3.00 each

110VAC MUFFIN FANS

New $11.95
Used $5.95

Transistors

2N2857JAN	2.50	2N3960JANTX	10.00	2N5645	10.00
2N2949	3.60	2N4072	1.60	2N5842	8.00
2N2947	15.00	2N4427	1.10	2N5849	20.00
2N2950	4.60	2N4429	7.00	2N5942	40.00
2N3375	8.00	2N4877	1.00	2N5946	14.00
2N3553	1.57	2N4959	2.00	2N5862	50.00
2N3818	5.00	2N4976	15.00	2N6080	7.00
2N3866	1.00	2N5070	8.00	2N6081	10.00
2N3866JAN	2.50	2N5071	15.00	2N6082	11.00
2N3866JANTX	4.00	2N5108	4.00	2N6083	13.00
2N3925	10.00	2N5109	1.50	2N6084	14.00
2N3948	2.00	2N5179	1.00	2N6095	11.00
2N3950	25.00	2N5583	4.00	2N6096	20.00
2N3959	3.00	2N5589	6.00	2N6097	28.00
		2N5590	8.00	2N6166	38.00
		2N5591	11.00	2N6368	22.99
		2N5635	5.44	A210/MRF517	2.00
		2N5636	11.60	BLY38	5.00
		2N5637	20.00	40280/2N4427	1.10
		2N5641	5.00	40281/2N3920	7.00
		2N5643	14.00	40282/2N3927	10.48

CRYSTALS

$4.95 each

5.120	7.4825	9.565	10.150	11.155	11.905	17.315
7.3435	7.4865	9.575	10.160	11.275	11.955	17.355
7.4585	7.4925	9.585	10.170	11.700	12.000	17.365
7.4615	7.4985	10.000	10.180	11.705	12.050	37.600
7.4625	7.5015	10.010	10.240	11.730	12.100	37.650
7.4665	7.5025	10.020	10.245	11.750	16.965	37.700
7.4685	7.5065	10.030	10.595	11.755	17.015	37.750
7.4715	7.7985	10.040	10.605	11.800	17.065	37.800
7.4725	7.8025	10.0525	10.615	11.850	17.165	37.850
7.4765	9.545	10.130	10.625	11.855	17.215	37.900
7.4785	9.555	10.140	10.635	11.900	17.265	37.950
7.4815						38.000

High Voltage Caps

30 MFD @ 500 VDC	1.69
22 MFD @ 500 VDC	1.69
100 MFD @ 450 VDC	2.29
150 MFD @ 450 VDC	3.29
225 MFD @ 450 VDC	4.29
.001/1000pF @ 10 KV	.89
.001 @ 3 KV	4/1.00
.0015 @ 3 KV	3/1.00
.01 @ 4 KV	.79
.01 @ 1.6KV	4/1.00
.02 @ 8 KV	2.00
.01 @ 1 KV	6/1.00

NEW 2" ROUND SPEAKERS
100 Ohm coil $.99 each

PLASTIC TO-3 SOCKETS
4/$1.00

CRYSTAL FILTERS
Tyco 001-19880 Same as 2194F
10.7 MHz narrow band
3 dB bandwidth 15 KHz min.
20 dB bandwidth 60 KHz min.
40 dB bandwidth 150 KHz min.
Ultimate 50 dB insertion loss 1 dB max.
Ripple 1 dB max. Ct. 0+/-5 pF 3600 Ohms
$3.99 each

78MO5
Same as 7805 but only 1/2 Amp
5 VDC .49 each or 10/$3.00

TRIMMER CAPS

Sprague. Stable Polypropylene.
.50 each or 10/4.00
not sold mixed
1.2 to 13pF
2 to 30pF
3.9 to 18pF
3.9 to 40pF
3.9 to 55pF

Carbide Circuit Board Drill Bits for PCB Boards
5 mix for $5.00

J-Fet

J310 N-CHANNEL J-FET 450 MHz
Good for VHF/UHF Amplifier, Oscillator and Mixers 3/$1.00

MURATA CERAMIC FILTERS

SFD 455D	455 KHz	2.00
SFB 455D	455 KHz	1.60
CFM455E	455 KHz	5.50
CFU 455H	455 KHz	3.00
SFE 10.7MA	10.7 MHz	2.99

TEXAS INSTRUMENT TIL-305P
5 x 7 array alphanumeric display
$3.85 each

See List of Advertisers on page 114

SEMICONDUCTORS SURPLUS

ATLAS FILTERS

ATLAS CRYSTAL FILTERS FOR ATLAS HAM GEAR

Your Choice

$15.95 ea.

5.645 - 2.7/8
5.595 - 2.7 USB
5.595 - 2.7/8/L
5.595 - 2.7 LSB
5.595 - .500/4
9.0 - USB/CW

Soldering Kit

New Weller Soldering Iron Kit
#SP-23F..... 9.99 each
Kit includes:
1 - 25 Watt soldering iron, develops 750° of tip temperature
3 - tips (screwdriver, chisel, cone)
1 - soldering aid tool
1 - coil 60/40 rosin core solder

CERAMIC PLATE CAPS

$1.09 each
#1 type for 3/8 plate cap
#2 type for 5/8 plate cap

Used NiCads

Used C Nickel Cadmium Batteries
1.8 amp hour
Pack of ten $8.99 per pack

CERAMIC COIL FORMS

$1.99 each

#1	3/16" x 4/8"
#2	3/16" x 1/4"
#3	1/4 " x 3/4"
#4	3/8 " x 7/8"
#5	3/8 " x 5/8"

All of the above have powdered iron cores.

#6	1/2"x 2 3/4"

NEW BOGNER DOWNCONVERTER
Industrial version.
1 year guarantee..... $225.00
NOT FOR SALE IN ARIZONA

UHF/VHF RF POWER TRANSISTORS
CD2867/2N6439
60 Watts output
Reg. Price $45.77
SALE PRICE..... $19.99

CHOKES

.1-3 uH	2.99
VIV .15 .15 uH	2.99
VIV 150 150 uH	2.99
5-20 uH	1.69
Variable coil 10-80 uH	2.99
Transformer dual 8.8 uH	1.00
.47 uH	1.00 ea. or 10/7.50
.68 uH	1.00 ea. or 10/7.50
1 uH	1.00 ea. or 10/7.50
1.2 uH	1.00 ea. or 10/7.50
1.5 uH	1.00 ea. or 10/7.50
2.2 uH	1.00 ea. or 10/7.50
2.7 uH	1.00 ea. or 10/7.50
3.3 uH	1.00 ea. or 10/7.50
6.5 uH	1.00 ea. or 10/7.50
7.5 uH	1.00 ea. or 10/7.50
10 uH	1.00 ea. or 10/7.50
15 uH	1.00 ea. or 10/7.50
20 uH	1.00 ea. or 10/7.50
22 uH	1.00 ea. or 10/7.50
33 uH	1.00 ea. or 10/7.50
39 uH	1.00 ea. or 10/7.50
47 uH	1.00 ea. or 10/7.50
50 uH	2.99
56 uH	1.69
62 uH	1.00 ea. or 10/7.50
68 uH	1.00 ea. or 10/7.50
100 uH	2.99
120 uH	1.69
185 uH	1.00 ea. or 10/7.50
538 uH	1.00 ea. or 10/7.50
680 uH	1.00 ea. or 10/7.50
1000 uH	1.00 ea. or 10/7.50
1630 uH	1.50
.1 mH	2.99
.2 mH	2.99
.22 mH	2.99
.27 mH	2.99
.33 mH	2.99
.39 mH	2.99
.240 mH	2.99
1.2 mH	2.99
1.5 mH	2.99
1.65 mH	2.99
1.75 mH	2.99
1.9 mH	2.99
1 mH	1.69
1.88 mH	3.99
2 mH	2.99
2.4 mH	2.99
2.5 mH	1.00 ea. or 10/7.50
2.7 mH	2.99
3.0 mH	2.99
3.6 mH	2.99
4.3 mH	2.99
4.7 mH	2.99
5 mH	2.99
5.11 mH	2.99
6 mH	2.99
7.2 mH	2.99
8.25 mH	2.99
8.28 mH	2.99
8.6 mH	2.99
10 mH	2.99
12 mH	2.99
15 mH	2.99
17 mH	2.99
19.6 mH	2.99
20 mH	2.99
20.5 mH	2.99
22.6 mH	2.99
24 mH	2.99
27.4 mH	2.99
28.7 mH	2.99
29.9 mH	2.99
30 mH	2.99
36 mH	2.99
36.5 mH	2.99
40 mH	2.99
40.2 mH	2.99
43 mH	2.99
47 mH	2.99
50 mH	2.99
59 mH	2.99
60 mH	2.99
71.5 mH	2.99
78.7 mH	2.99
86 mH	2.99
100 mH	2.99
120 mH	2.99
150 mH	2.99
175 mH	2.99
200 mH	2.99
205 mH	2.99
237 mH	2.99
240 mH	2.99
300 mH	2.99
360 mH	2.99
390 mH	2.99
430 mH	2.99
500 mH	1.50
600 mH	2.99
1000 mH	2.99
1.5 Hy	2.99
2.0 Hy	2.99
2.5 Hy	2.99
3.0 Hy	2.99
5.0 Hy	2.99
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HIGH VOLTAGE CAPS

420 MFD @ 400 VDC	3.99 each
600 MFD @ 400 VDC	3.99 each

New Fairchild Prescaler Chip

95H90DCQM..... 6.50 each
350 MHz prescaler divide by 10/11

1.9-2.5G CONVERTERS

1900 MHz to 2500 MHz DOWNCONVERTERS
Intended for amateur radio use.
Tunable from channel 2 thru 6.
34 dB gain 2.5 to 3 dB noise.
Warranty for 6 months
NOT FOR SALE IN ARIZONA
Model HMR 11
Complete Receiver and Power Supply
(does not include coax)..... $225.00

4 foot Yagi antenna only..... $39.99
Downconverter Kit - PCB and parts.. $69.95
Power Supply Kit -
Box, PCB and parts..... $49.99
Downconverter assembled..... $79.99
Power Supply assembled..... $59.99
Complete Kit form $109.99
(includes Yagi antenna and instructions)
REPLACEMENT PARTS
MRF901..... $ 3.99
MBD101..... 1.29
.001 Chip Caps 1.00
Power Supply PCB 4.99
Downconverter PCB..... 19.99
Instructions for any separate item 10.00

NEW TRANSFORMERS

		Price each
F-18X	6.3 VCT @ 6Amps	6.99
F-46X	24V @ 1Amp	5.99
F41X	25.2VCT @ 2Amps	6.99
P-8380	10VCT @ 3Amps	7.99
P-8604	20VCT @ 1Amp	4.99
K-32B	28VCT @ 100 MA	4.99
E30554	Dual 17V @ 1Amp	6.99

DIODES

HEP 170
3.5 A, 1000 PIV
.20 ea., 100 for $15.00

D61005
1.5 A, 1000 PIV
.15 ea., 100 for $12.00

HVK 1153
25 mA, 20,000 PIV
$1.00 ea., 10 for $8.00

Fairchild LEDs
FLV 5007 & 5009 red.
Case type TO-92.
6/$1.00

SCMS 10K
15 mA, 10,000 PIV
$1.69 ea., 10 for $12.50

High-voltage diode EK500
5000 Volts, 50 mA
.99 each

Motorola SCR
TO-92 Case, 0.8 Amp, 30 V.
Igt 0.2 Vgt 0.8.
Same as #N5060.
4/$1.00 or 100/$15.00

Dialco Type 555-2003
LED 5 VDC with built-in resistor.
.69 each

Motorola MA 752 Rectifier
6 Amps, 200 PIV
4/$1.29

NEW BCD SWITCH
8 switch with end plates
Model TSM200-1011 (CDI) $16.87

CONTINUOUS TONE BUZZERS
12VDC..... $2.00 each

EIMAC FINGER STOCK #Y-302
36 in. long x 1/2 in. $4.99 each

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$22.50 per spool

#24	A.W.G.	9 lb.
#26	A.W.G.	9 lb.
#25	A.W.G.	9 lb.
#30	A.W.G.	8 3/4 lb.
#31	A.W.G.	6 lb.

CORES
4/1.00

T20-12	T30-6	T37-6
T25-6	T30-12	T37-10
T30-2	T37-2	T44-6

CABLE TIES
#/T-18R 100 per bag
mil. spec. #MS-3368S, 4"
Made by Tyton Corp.
$2.50 per bag
100 bags - $20.00

Miniature Ceramic Trimmers
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CV31D350	2 to 8 pF
HM00-4075-03	3.5 to 11 pF
300425	3.5 to 13 pF
E5-25A	5 to 25 pF
	5.1 to 40 pF
	3.5 to 15 pF
	5.2 to 40 pF
	2.5 to 6 pF

CERAMIC STAND OFFS

#CNP-5	3/8 x 5/8"	.29 each
	7/16 x 1 1/4"	.39 each
#N54W0112	3/8 x 1 1/2"	.49 each
#NL523W03-010	3/4 x 1 1/4"	.79 each

CORES AND BEADS

#43	Shield Bead	4/1.00
#61	Toroid	3/1.00
#43	Balun	10/1.00
#61	Balun	8/1.00
#61	Balun	6/1.00
#61	Balun	4/1.00
#61	Beads	10/1.00
Ferrite Rod 1/4 x 7 1/2		2.99
Ferrite Beads 1/8" long		12/1.00
Ferrite Beads 3/8" long		6/1.00
Ferrite Beads 1/16" long		12/1.00

DOOR KNOB CAPS

470 pF @ 15 KV	$3.99 each
Dual 500 pF @ 15 KV	5.99 each
680 pF @ 6 KV	3.99 each
800 pF @ 15 KV	3.99 each
2700 pF @ 40 KV	5.99 each

TRANSFORMERS
$9.99 each
#2899652-01
26.8 VCT @ 660 MA
21.9 VCT @ 1.1 Amps
$1.99 each
#18000711P
24 V @ 100 MA
$12.99 each
#2099459-00
28 V @ 1.5 Amps
9.6V @ 9 Amps
16.8 V @ 300 MA

JUMBO LED'S

Red	8/$1.00
Clear	6/$1.00
Yellow	6/$1.00
Green	6/$1.00
Amber	6/$1.00

MEDIUM LED'S

Red	6/$1.00
Green	6/$1.00

NE555V TIMERS
.39 each or 10/$5.00

NEW DUAL COLON LED
.69 each or 10/$5.00

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75 uH	3.00
.94 mH	3.99

TRANSISTORS/IC'S

Motorola MHW 252 VHF power amplifier.
Frequency range: 144-148 MHz.
Output power: 25W.
Minimum gain: 19.2 dB.
$29.67 each

Motorola MC 1316P.
House no. same as HEP C6073 & EC9814.
2-W audio amplifier.
$1.29 ea., 10 for $9.50

Fairchild 007-03 IC.
ECG no. 707 Chroma demodulator.
$1.29 ea., 10 for $8.50

Motorola rf transistors.
Selection Guide & Cross-Reference Catalog.
43 pgs.
$1.99 each

RCA Triacs.
Type T2310A.
TO-5 Case with heat sinks.
1.6 Amp, 100 VDC, Igt 3mA.
Sensitive gate.
$1.00 each

RCA power transistors.
NPN RCS 258.
Vceo 60 NFE 5mA.
IC 20 Amps Vce 4V.
250 Watts, Ft 2 MHz.
$3.00 each

RCA Triacs.
Type T4121B/40790.
200 VDC 10 Amps.
Stud type.
$3.69 each

RCA Triacs.
Type 40805/T6421D.
30 Amps, 400 VDC.
$5.00 each

Motorola rf amplifier.
544-4001-002, similar to type MHW 401-2.
1.5 Watts output. 440-512 MHz.
15 dB gain min. $19.99 each

ORDERING INSTRUCTIONS

Check, money order, or credit cards welcome. (Master Charge and VISA only.) No personal checks or certified personal checks for foreign countries accepted. Money order or cashiers check in U.S. funds only. Letters of credit are not acceptable.
Minimum shipping by UPS is $2.35 with insurance. Please allow extra shipping charges for heavy or long items.
All parts returned due to customer error or decision will be subject to a 15% restock charge. If we are out of an item ordered, we will try to replace it with an equal or better part unless you specify not to, or we will back order the item, or refund your money.
PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. Prices supersede all previously published. Some items offered are limited to small quantities and are subject to prior sale.
We now have a toll free number, but we ask that it be used for *charge orders only*. If you have any questions please use our other number. We are open from 8:00 a.m. - 5:00 p.m. Monday thru Saturday.
Our toll free number for *charge orders only* is 800-528-3611.

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He said we have too much inventory — The warehouse if FULL! *We cut prices and he went* **CRAZY . . . he slashed the prices even lower!** *You won't see prices this low on these items ever again. We apologize for his insanity but don't feel like you should ignore the super deals just because they came from a ding bat (Don't tell him we said that).* ***Buy before he snaps out of it.***

YOU MUST ORDER BEFORE OCT. 6!

TIP150 NPN
7A 300 VCEO
Fast Switch
99¢

SCR 400 PIV 4A
House #
5/1.00

50285 MOS IC
Special Oven Timer/ Controller. Can be pre-set to count down in minutes and seconds. Schematic included.
99¢

ZENER
1N4732 1W 4.7V
20/1.00

SINGLE TURN PC MOUNT TRIMPOTS
500 Ohm
8/1.00

ASSORTMENTS

1. Panel Mount Volume Controls	10/1.50
2. Rotary Switches	6/1.25
3. Slide Switches	12/.89
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6. 1/4 W Resistor Full & PC Leads 200 Pieces Minimum	1.99
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8. 6" Lengths of Heat Shrinkable Tubing 1/8 to 3/8" Dia. 10 Pieces	.89

MPS A13 NPN Darlington
5/.88

TIS180 J-FET CUT LEADS
Leads are 3/16" long. Prime units otherwise.
20/1.00

2N5375 General Purpose
PNP Small Signal
30 VCEO
360 MW
8/1.00

DON'T DELAY
The boss is getting saner by the minute!

LIMIT 50 PER CUSTOMER

LM324 Quad OP Amp	**.50**
CD4518 Dual BCD Counter	**.75**
CD4511 BCD to 7 Seg Driver	**.50**
CD4051 Analog Multiplexer/ 8 Channel Switch	**.50**
501 Quad Segment Driver (Same as 75491)	**.25**
2101 Memory Chip	**.75**
LM339 Quad Comparator	**.50**
MC1414 Dual Comparator	**5/1.00**
1458 Dual OP Amp (Mini Dip)	**3/1.00**
LM358 Dual OP Amp (Mini Dip)	**3/1.00**

TRANSISTOR !GRAB BAG!
Several boxes got mixed. These are NPN's, PNP's, SCR's, etc. Marked and unmarked units. **You Sort, You SAVE! 100 for 2.50.**

YOU'LL SAVE LIKE CRAZY!

Skirted Instrument Knob 1/4" Shaft	.25
Transistor Radio Earphones	.10
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7.2 VDC @ 100MA Wallplug XFMR	1.75
S/RF Meter 2MA F.S. Movement	.99
150VAC 2-1/4" Square Meter	2.75
51,000 MFD @ 40V Computer Cap	2.75
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ADD *5%* FOR SHIPPING AND HANDLING.
ORDERS FROM THIS AD MUST BE POSTMARKED BEFORE OCT. 6th.
ALL ITEMS LIMITED QUANTITY. NO OTHER DISCOUNTS OR COUPONS ALLOWED.
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ALL FOREIGN ORDERS ADD 30% FOR AIRMAIL SHIPPING.

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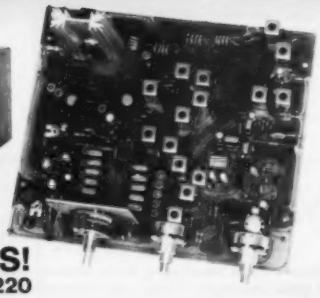
• LINKS • REPEATERS • TRANSMITTERS
• RECEIVERS • PREAMPS • CONVERTERS
• TRANSCEIVERS • POWER SUPPLIES • PA'S

QUALITY VHF/UHF KITS AT AFFORDABLE PRICES



SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

10 watts, 5 Channels, for 6M, 2M, or 220

Hamtronics® Does it Again!

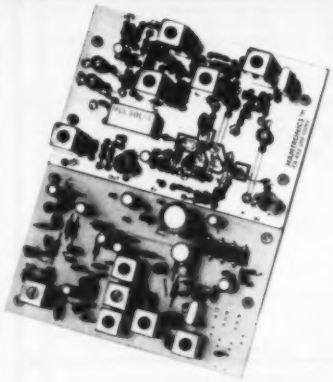
Where else can you get a value-packed radio at such reasonable cost?

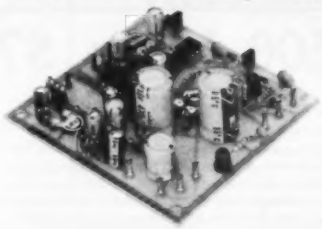
FM-5 PC Board Kit – ONLY $159.95
complete with controls, heatsink, etc.

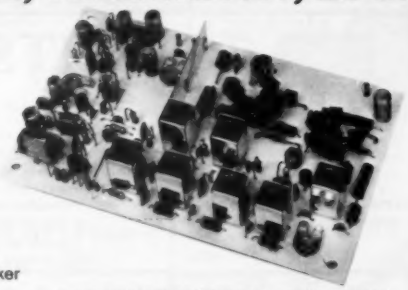
Cabinet kit, microphone, crystals, etc. available separately

Request catalog for full details.

HIGH QUALITY FM MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.







- **R75 VHF FM RECEIVER** for 10M, 6M, 2M, 220, or commercial bands. 4 fantastic selectivity options. Kits from $84.95 to $119.95
- **R450 UHF FM RECEIVER** for 380-520 MHz bands. Kits in selectivity options from $94.95
- **R110 VHF AM RECEIVER** Kit for vhf aircraft band or ham bands. Only $84.95.

- **COR KITS** With audio mixer and speaker amplifier. Only $29.95.
- **CWID KITS** 158 bits, field programmable, clean audio. Only $59.95.
- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Only $18.00.
- **SCANNER CONVERTERS** Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $79.95.

- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous. Kits only $54.95.
- **T451 UHF FM EXCITER** for 450 ham band or adjacent. Kits only $64.95.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Kits from $69.95.

VHF & UHF TRANSMITTING CONVERTERS

For SSB, CW, ATV, FM, etc. Available for 6M, 2M, 220, 440 with many IF input ranges. Converter board kit only at $79.95 (VHF) or $99.95 (UHF) or kits complete with PA and cabinet as shown.

VHF & UHF RECEIVING CONVERTERS

20 Models cover every practical rf and if range to listen to SSB, FM, ATV, etc. on 6M, 2M, 220, 440, and 110 aircraft band. Even convert weather down to 2M! Kits from $39.95 and wired units.

VHF & UHF RECEIVER PREAMPS. Low noise.

VHF Kits from 27 to 300 MHz. UHF Kits from 300 to 650 MHz. Broadband Kits: 20-650 MHz. Prices start at $14.95 (VHF) and $18.95 (UHF). All preamps and converters have noise figure 2dB or less.

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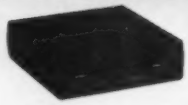
ramsey the first name in Counters !



9 DIGITS 600 MHz $129.95 WIRED

PRICES

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack +AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

$29.95 Kit $39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

$34.95 Kit $44.95 Wired

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TERMS - Satisfaction guaranteed - examine for 10 days, if not pleased return in original form for refund. Add 5% for shipping insurance to a maximum of $10. Overseas add 15%. COD add $2. Orders under $10 add $1.00. NJ residents add 7% tax.

DIGITAL RESEARCH: PARTS

"TOP QUALITY PARTS FOR LESS"

MA1010A Clock Module

4.25

- Giant .84" LED
- Complete - add only transformer and switches.
- 12 hour display format
- 50 or 60 HZ operation
- Power failure indication
- Brightness control capability
- PM indicator
- Fast and slow set controls

MC6871A IMHZ Crystal Oscillator

- Designed specifically to drive 6800 MPU.
- Frequency — 1 MHZ Std.
- Frequency stability ± .01%
- Operating temp. range 0°C to 70°C
- Input voltage + 5V.
- Fits standard 24 pin socket.

7.50

Universal Timer Kit

NEW!

8.95

★ Adjustable from 1 sec to 1 hr.
★ Control up to 1 amp

"TURN THINGS ON OR OFF"

Kit includes all parts necessary to build this exciting kit. Uses: Children's T.V. programs - Darkroom exposures - Amateur 10 min. I.D.er - Egg Timer - Intermittent Windshield Wiper. Absolutely endless uses. Complete kit including power supply, p.c. board - DPDT relay, and all parts to make timer operational.

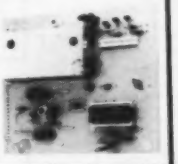
Video Game Board

Hockey • Tennis • Handball

- General Instruments AY3-8500
- Features Exciting Sounds
- On Screen Scoring
- 1 or 2 Players
- Speed & Paddle Controls
- Works on 9 Volts D.C.

4.45

3 for 12.00



Each board comes with RF Modulator (Ch. 3 or 4) and schematic. The only parts needed to complete game are speaker, 2-1 Meg Pots & Switches.

Video Paddle Controls

2 for 1.00

Can be used with game board at left.

Switching Power Supply

An absolutely fantastic bargain exclusively from Digital Research.

- Precision and quality at its finest.

Input Voltage 120 or 240 VAC - Output Voltage + 5.15VDC @ 6 amps, + 12VDC @ 1.5 amps, −12VDC @ 1 amp, −45VDC @ .02 amps, + 70VDC @ .5 amp, −250VDC @ .2 amps. Measures 12 x 7¼ x 2¼ in.

Open frame - as is — **75.00**

Transformer

32VCT @ 1 amp
6V @ 1 amp

3.25

Measures:
2" x 2¼" x 2¼"
2⅞" Mounting Centers

Sprague RFI Filter

3.65 or 3/9.00

Perfect for Computers, or anything that needs to be "glitch" free. By the #1 name in filtering, Sprague. JN17-5109B. Has I.E.C. Power Line Connector. 2x3 Amp. 115/220 VAC 60 Hz. 2⅛" x 2½" x 3" deep.

5 Watt Zeners

6.8v	15v	48v
11v	24v	55v
12.6 v	30v	60v

5% • Some House Numbered Cut & Formed • Prime

10 for 1.00

IN4735 • 6.2V • 1 Watt
Cut & Formed **20/1.00**

Micro Mini Toggle Switch

99¢

6 for 5.00

SPDT • Made in USA with Hardware

RCA Triac

79¢

5 for 3.50

T2800M-TO220 Case
6 Amp 600 Volt

IC Specials

MC1488-1489-RS232 Driver and Receiver - **99¢ pr.**
LM1889 - Special **1.75**
MC1310 - H.N. Spec. **1.00**
LM3820 - A.M. Radio on a chip w/specs. **2/1.00**

JFET OP AMP

Super High Input Impedance (10^{12} OHMS) — High Frequency Response. TO 4 MHZ. Large DC Voltage Gain 106 DB — New generation OP-AMP with Vastly Superior Features!

LF356BH - **75¢ or 3/2.00**

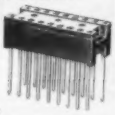
Scotch Lok

Great for connecting a wire to an existing wire without stripping. Absolutely invaluable in hard to reach areas such as under car dash, inside television, etc. Simply put Scotch Lok over existing wire. Insert new wire to be connected. With a standard pair of pliers, compress metal on insulator. No need for tape. Super neat installation. Once you use this, you will never go back to the "old" way.

15/1.00

Gold Wire Wrap Sockets

Not Cheap Gold Inlay as Sold By Others.



Super 3 Level Gold Wire Wrap.

14 Pin - **10/3.95, 25/8.75**
16 Pin - **10/4.95, 25/11.25**

Voltage Regulators

LM309K + 5 Volt TO-3 1 amp
7812CK + 12 Volt TO-3 1 amp

Special **1.00**

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NEW RELEASES & POPULAR ITEMS

IMPROVE YOUR RECEPTION!

OUR MOST POPULAR PREAMPLIFIER

MODEL PLF-2 **$52.95**

AMECO ALL-BAND PREAMP!

- 6-160 Meters
- 20+ dB Gain
- Low Price

MODEL PLF-2 ... Improves weak signals as well as image and spurious rejection of most receivers. Direct switching to rec. or preamp. Includes pwr. supp. 117 VAC wired & tested ... **$52.95**
MODEL PLF-2E ... 240 VAC 50-60 Hz operation ... **$57.95**
MODEL PT-2 ... For transceiver use. Continuously tunable from 6 to 160 meters. Features dual-gate FET transistor amplifier for improved receiver sensitivity and low noise figure. Requires no transceiver modifications and can handle up to 250W transceiver output. 117 VAC 60 Hz ... **$79.95**
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PARTS TO BUILD YOUR OWN ANTENNA

CABLE

8U FOAM, hi dens braid 50 ft.	$14.95
8U FOAM, hi dens braid 100 ft.	28.00
RG58A/U stranded center 50 ft.	6.95
RG58A/U stranded center 100 ft.	10.95
RG58 3 ft w/PL259 each end.	3.35
RG58 5 ft w/PL259 each end.	4.39
RG58 50 ft w/PL259 each end.	9.95

COPPER WIRE

#14 stranded, 100 ft spool.	6.95
#14 solid copper enameled 100'.	6.95

INSULATORS

Egg ins, porcelain per pair.	.99
DOG BONE, porcelain set of 3.	1.50
HY GAIN #155 center insulator.	5.95
HY GAIN Cycolac end ins per pair.	3.95

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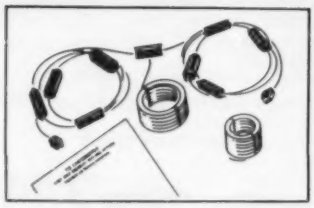
SHIPPING CHARGES
(Continental USA only)

All Ameco preamplifiers: **$3.00**
All "Build your own" antenna parts: **$2.00** 1st item; **50c** each additional item.
Eavesdropper Antenna: **$3.00**
Moxley SWV-7: **$5.00**
B&W Portable Whip: **$3.00**
Mini-Reader: **$2.50**

NOTE: INTERNATIONAL ORDERS write for Proforma Invoice.



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All the world's shortwave broadcast bands are yours with the Eavesdropper All-Band antenna. Individually tuned traps make the Eavesdropper work like seven separate antennas, each tuned to a different international broadcast band. Also covers 11, and 60M bands as well. Its 100 foot, 72 ohm balanced feedline provides an exact match to the antenna on every band. Comes completely assembled, and ready to install with 50 ft. of 450 lb. test nylon rope. Overall length: 42'10". Wire: #14 copper clad steel. Bandswitching: Automatic. Impedance to rcvr: 50-75 ohms balanced.

Only $59.95

Eavesdropper

SHORT WAVE BROADCAST RECEIVING ANTENNA

$59.95

- COMPLETELY WEATHERPROOF!
- COMPLETE, NO ASSEMBLY NEEDED!
- 60, 49, 41, 31, 25, 19, 16, 13 & 11M BANDS!

B&W PORTABLE WHIP ANTENNA

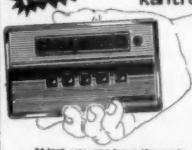
Quick Mounting
$34.50

Simple, dependable whip is designed especially for apartment dwellers and renters who cannot install a permanent antenna. Tunes the 2, 6, 10, 15, 20 and 40-meter Amateur bands. Offers VSWR of 1.1:1 when properly adjusted to operating frequency. Ideal for use as a portable emergency antenna, too. Amounts to almost any horizontal support with a simple clamp bracket.

Weighs less than 2 pounds including five base-loading coils (not used for 6/2 meters), coax line and counterpoise. Whip is 22½" long disassembled, extends to 57". Mount is 14" long. Power rating: 360 watts SSB or CW.

Model 370-10 ... **$34.50**

NEW! Introducing the versatile Kantronics **Mini-Reader™**



ONLY
$299.95
List $319.95

Buy 2, including code-speed display, automatic Morse speed tracking, demodulator output, a tuning eye, code-editing programs and a 24-hour clock.

At last, you can have the code-reading functions for Morse, RTTY and ASCII combined in a miniature package. The **Mini-Reader** has all the functions of its larger counterpart, the **Field**

But the **Mini-Reader** measures only 5.74" by 3.5" by 1" and runs on 12 volts! Its calculator size still leaves room for a 10-character, vacuum-tube flourescent display

2 METER ANTENNAS at BARGAIN PRICES!!

Hy-gain

3 db GAIN MAGNETIC MOUNT

ONLY
$19.95

Model 287
Wt. 2.5 lbs.

An economical alternative to drilling a hole. A magnetic antenna by a name you can trust at a low, low price.

Add $2.00 Shipping

Model 286 Same but trunk lid. ... **$15.95 b**

"SLINKY" Dipole Antenna

A lot of performance in a little space, on 80/75, 40 and 20 meters. Only one setting needed for full band coverage—low VSWR throughout. Can be set at any length from 24-40' on 80/75 meters, 12-35' on 40, 6-18' on 20. Band change takes less than a minute. Handles 1000 watts CW, 2000 PEP on SSB. With 50' RG-58/U coax ... **$49.95**

7400

SN7400N	.25	SN7472N	.29	SN74156N	.79
SN7401N	.29	SN7473N	.35	SN74157N	.69
SN7402N	.25	SN7474N	.35	SN74160N	.99
SN7403N	.25	SN7475N	.49	SN74161N	.99
SN7404N	.25	SN7476N	.35	SN74162N	.99
SN7405N	.29	SN7479N	5.00	SN74163N	.99
SN7406N	.35	SN7480N	.50	SN74164N	.99
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SN7409N	.29	SN7485N	.89	SN74167N	2.79
SN7410N	.25	SN7486N	.35	SN74170N	1.95
SN7411N	.35	SN7489N	1.75	SN74172N	4.95
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SN7414N	.69	SN7492N	.45	SN74175N	.99
SN7416N	.29	SN7493N	.45	SN74176N	.79
SN7417N	.29	SN7494N	.69	SN74177N	.79
SN7420N	.25	SN7495N	.69	SN74179N	1.49
SN7421N	.29	SN7496N	.69	SN74180N	.79
SN7422N	.45	SN74H71N	1.89	SN74181N	2.25
SN7423N	.29	SN74100N	1.49	SN74182N	.79
SN7425N	.29	SN74104N	.89	SN74184N	2.49
SN7426N	.29	SN74105N	.89	SN74185N	2.49
SN7427N	.29	SN74107N	.35	SN74190N	1.25
SN7428N	.49	SN74109N	.39	SN74191N	1.25
SN7430N	.25	SN74116N	1.95	SN74192N	.89
SN7432N	.29	SN74121N	.39	SN74193N	.89
SN7437N	.35	SN74122N	.55	SN74194N	.89
SN7438N	.40	SN74123N	.59	SN74195N	.69
SN7439N	.35	SN74125N	.49	SN74196N	.89
SN7440N	.29	SN74126N	.49	SN74197N	.89
SN7441N	.69	SN74132N	.75	SN74198N	1.49
SN7442N	.59	SN74136N	.75	SN74199N	1.49
SN7443N	1.10	SN74141N	.99	SN74221N	1.25
SN7444N	1.10	SN74142N	4.95	SN74251N	.99
SN7446N	.89	SN74143N	3.49	SN74276N	1.95
SN7446N	.79	SN74144N	3.49	SN74279N	.79
SN7447N	.69	SN74145N	.79	SN74283N	1.49
SN7448N	.79	SN74147N	1.95	SN74284N	3.95
SN7450N	.20	SN74148N	1.29	SN74285N	3.95
SN7451N	.20	SN74150N	1.25	SN74366N	.69
SN7453N	.20	SN74151N	.69	SN74368N	.69
SN7454N	.20	SN74152N	.69	SN74386N	.69
SN7459A	.25	SN74153N	.79	SN74368N	.69
SN7460N	.20	SN74154N	1.25	SN74390N	1.49
SN7470N	.29	SN74155N	.79	SN74393N	1.49

74LS

74LS00	.29	74LS92	.75	74LS182	1.15
74LS01	.29	74LS93	.75	74LS193	1.15
74LS02	.29	74LS95	.99	74LS194	1.15
74LS03	.29	74LS96	1.15	74LS195	1.15
74LS04	.35	74LS107	.45	74LS197	1.15
74LS05	.35	74LS112	.45	74LS221	1.19
74LS08	.35	74LS107	.45	74LS240	1.49
74LS09	.35	74LS109	.45	74LS241	1.49
74LS10	.35	74LS112	.45	74LS242	1.49
74LS11	.39	74LS113	.49	74LS243	1.49
74LS12	.39	74LS114	.49	74LS244	1.49
74LS13	.59	74LS122	.89	74LS245	2.95
74LS14	.99	74LS123	1.25	74LS247	1.19
74LS15	.39	74LS125	.59	74LS248	1.19
74LS20	.35	74LS126	.59	74LS249	1.19
74LS21	.35	74LS132	.89	74LS251	.99
74LS22	.35	74LS133	.89	74LS253	.99
74LS26	.39	74LS136	.69	74LS257	.99
74LS27	.35	74LS138	.89	74LS258	.69
74LS28	.35	74LS139	.89	74LS260	.69
74LS30	.35	74LS151	.89	74LS266	.69
74LS32	.35	74LS153	.89	74LS273	1.95
74LS33	.59	74LS154	1.75	74LS279	.89
74LS37	.39	74LS155	.89	74LS283	.89
74LS38	.39	74LS156	.89	74LS290	.99
74LS40	.35	74LS157	.89	74LS293	.99
74LS42	.89	74LS158	.89	74LS298	1.25
74LS47	.89	74LS160	1.15	74LS352	1.29
74LS48	1.15	74LS161	1.15	74LS353	1.29
74LS49	1.15	74LS162	1.15	74LS365	.69
74LS51	.35	74LS163	1.15	74LS366	.69
74LS54	.35	74LS164	1.15	74LS367	.69
74LS55	.35	74LS165	1.15	74LS368	.69
74LS73	.45	74LS168	1.19	74LS373	1.95
74LS74	.45	74LS169	1.19	74LS374	1.95
74LS75	.59	74LS170	1.95	74LS375	.89
74LS76	.45	74LS173	.99	74LS386	.69
74LS78	.49	74LS174	.99	74LS393	2.49
74LS83	.89	74LS175	.99	74LS399	2.49
74LS85	1.25	74LS181	2.95	74LS670	2.49
74LS86	.49	81LS95	1.25	81LS96	.95
74LS90	.69	74LS191	1.25	81LS97	1.95

74S

74S00	.45	74S133	.55	74S253	1.45
74S02	.45	74S134	3.95	74S257	1.45
74S03	.45	74S135	1.19	74S258	1.35
74S04	.55	74S136	1.75	74S260	.79
74S05	.55	74S138	1.35	74S280	2.95
74S08	.50	74S139	1.35	74S287	3.25
74S09	.50	74S140	.79	74S288	2.75
74S10	.45	74S151	1.35	74S373	3.49
74S11	.45	74S153	1.35	74S374	3.49
74S15	.45	74S157	1.35	74S387	2.95
74S20	.45	74S158	1.35	74S471	19.95
74S22	.45	74S160	2.95	74S472	10.95
74S32	.55	74S162	2.95	74S473	10.95
74S38	1.25	74S169	2.95	74S474	12.95
74S40	.50	74S174	1.95	74S475	12.95
74S51	.45	74S175	1.95	74S570	5.95
74S64	.50	74S188	2.95	74S571	5.95
74S65	.50	74S194	1.95	74S572	5.95
74S74	.75	74S195	1.95	74S573	9.95
74S86	.75	74S196	1.95	74S574	9.95
74S112	.79	74S240	2.95	74S940	3.15
74S113	.79	74S241	2.95	74S941	3.15
74S114	.79	74S242	3.25	74S941	3.15

CA–LINEAR

CA3010H	.99	CA3050N	3.25	CA3089N	3.75
CA3013H	2.15	CA3052N	3.25	CA3096N	1.95
CA3023H	3.25	CA3080H	1.25	CA3130H	1.39
CA3035H	2.40	CA3081H	2.80	CA3140H	1.25
CA3039H	1.25	CA3082N	2.00	CA3160H	1.25
CA3046N	1.30	CA3083N	1.60	CA3401N	.59
CA3059N	3.25	CA3085N	.85	CA3600N	3.50

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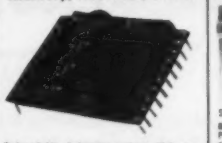
CD4000	.39	CD4081	1.49	CD 4098	2.49
CD4001	.39	CD4082	.99	CD4506	.75
CD4002	.39	CD4083	1.49	CD4507	.59
CD4006	1.19	CD4085	.99	CD4508	3.95
CD4007	.25	CD4086	.99	CD4510	1.39
CD4009	.49	CD4093	.89	CD4511	1.29
CD4010	.49	CD4094	.89	CD4512	1.49
CD4011	.39	CD4095	1.79	CD4514	3.95
CD4012	.25	CD4097	2.50	CD4515	2.95
CD4013	.49	CD4098	1.35	CD4516	1.49
CD4014	1.39	CD4099	.99	CD4518	1.79
CD4015	1.19	CD4060	.99	CD4519	.89
CD4016	.59	CD4051	1.19	CD4520	1.29
CD4017	1.19	CD4052	1.19	CD4526	1.79
CD4018	.99	CD4053	1.19	CD4528	1.79
CD4019	.49	CD4055	2.95	CD4529	1.95
CD4020	1.19	CD4059	9.95	CD4542	2.79
CD4021	1.39	CD4060	1.49	CD4552	11.95
CD4022	1.19	CD4066	.79	CD4566	2.79
CD4023	.29	CD4068	.39	CD4583	2.49
CD4024	.79	CD4069	.45	CD4584	.79
CD4025	.23	CD4070	.55	CD4723	1.95
CD4026	2.95	CD4071	.49	CD4724	1.95
CD4027	.69	CD4072	.49	MC14409	14.95
CD4028	.89	CD4073	.39	MC14410	14.95
CD4029	1.49	CD4075	.39	MC14411	14.95
CD4030	.49	CD4078	1.35	MC14412	11.95
CD4034	3.49	CD4078	.55	MC14419	4.95
CD4035	.89	CD4081	.45	MC14433	13.95
CD4040	1.49	CD4082	.39	MC14536	2.49
		CD4093	.99	MC14541	1.95

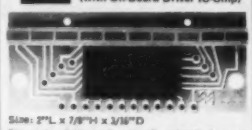
4-Digit 16 Segment Alphanumeric Intelligent Display with Memory, Recorder, Driver



End-stackable, 4-character package. High contrast, 160mil high, magnified monolithic characters. 64-Character ASCII format. Built-in memory, decoder, multiplexer and drivers. Direct access to each digit independently and asynchronously. Five volt logic, TTL compatible. Five volt power supply only. Independent cursor function. Size: 1"L x 1-3/16"H x .225"D.

DL-1416 Alphanumeric Display **$19.95 ea.**

10-Segment Bargraph Displays (with On-Board Driver IC-Chip)



Size: 2"L x 7/8"H x 3/16"D

Bar or dot display mode externally selectable by user. Packages are end-stackable for expanded displays. Can be cascaded to 10 arrays (100 bargraph elements). LED current programmable from 2mA to 30mA. Stable internal voltage reference for full scale analog inputs from 1.2 to 12V. Each LED output of driver IC with external access. Bias: 2"x7/8"x3/16".

NSM3914	Linear Function (10 bars red)	$6.95
NSM3914B	Linear Function (8 bars green/4 red)	6.95
NSM3915	Logarithmic Function (10 bars red)	6.95
NSM3915B	Logarithmic Func. (6 grn./2 yell./2 red.)	6.95
NSM3916	VU-Meter Function (10 bars red)	6.95
NSM3916B	VU-Meter Func. (6 grn./2 yell./2 red.)	6.95

DISCRETE LEDS

XC556R	.200" red	5/$1	MV50	.085" red	6/$1
XC556G	.200" green	4/$1	XC209R	.125" red	5/$1
XC556Y	.200" yellow	4/$1	XC209G	.125" green	4/$1
XC556C	.200" clear	4/$1	XC209Y	.125" yellow	4/$1
XC22R	.200" red	5/$1	XC526R	.185" red	4/$1
XC22G	.200" green	4/$1	XC526G	.185" green	4/$1
XC22Y	.200" yellow	4/$1	XC526Y	.185" yellow	4/$1
MV10B	.170" red	4/$1	XC526C	.185" clear	4/$1

.200(T1¾) Red/Green Diffused Bi-Color LED

Part No.	1-99	100+
XC5491	.79	.69

XC5M RED LED, METAL MTG. HDW., 2 LEADS

RL-2 . . **$.39 ea. or 3/$1.00**

DISPLAY LEDS

C.A. — Common Anode
D.D. — Double Digit

Type	Polarity	Ht	Price
MAN 1	C.A.—red	.270	2.95
MAN 2	5x7 D.M.—red	.300	4.95
MAN 3	C.C.—red	.125	.28
MAN 52	C.A.—green	.300	.59
MAN 54	C.C.—green	.300	.59
MAN 71	C.A.—red	.300	.75
MAN 72	C.A.—red	.300	.75
MAN 74	C.C.—red	.300	1.25
MAN 82	C.A.—yellow	.300	.49
MAN 84	C.C.—yellow	.300	.59
MAN 3620	C.A.—orange	.300	.49
MAN 3630	C.A.—orange ± 1	.300	.59
MAN 3640	C.C.—orange	.300	.59
MAN 4610	C.A.—orange	.400	.99
MAN 6610	C.A.—orange—DD	.560	.99
MAN 6630	C.A.—orange ± 1	.560	.99
MAN 6640	C.C.—orange—DD	.560	.99
MAN 6660	C.C.—orange ± 1	.560	.99
MAN 6710	C.A.—red—DD	.560	.99
MAN 6740	C.C.—red—DD	.560	.99
MAN 6750	C.C.—red ± 1	.560	.99
DLO300	C.C.—orange—DD	.300	1.25
DLO307	C.A.—orange	.300	1.25
DLG500	C.C.—green	.500	1.25

C.C. — Common Cathode
RHD — Right Hand Decimal

Type	Polarity	Ht	Price
DLG507	C.A.—green	.500	1.25
DL704	C.C.—red	.300	1.25
DL707	C.A.—red	.300	1.25
DL728	C.C.—red	.500	1.49
DL741	C.A.—red	.600	1.25
DL747	C.A.—red	.600	1.49
DL750	C.C.—red	.600	1.49
DLO847	C.A.—orange	.800	1.49
DLO850	C.C.—orange	.800	1.49
DL33B	C.C.—red	.110	.35
FND358	C.C. ± 1	.357	.99
FND357	C.C.	.357	.75
FND500	C.C. (FND503)	.500	.99
FND507	C.A. (FND510)	.500	.99
HDSP-3401	C.A.—red	.300	1.50
HDSP-3403	C.C.—red	.300	1.50
HDSP-3405	C.C. red ±1	.300	1.50
5082-7751	C.A.,R.H.D.—red	.430	1.25
5082-7760	C.C.,R.H.D.—red	.430	1.25
5082-7300	4x7 Numeric (RHD)	.600	22.00
5082-7302	4x7 Numeric (LHD)	.600	22.00
5082-7340	4x7 Hxdcl. (0-9/A-F)	.600	22.50
4N28	Photo Xsistor Opto-Isol.		.69
LIT-1	Photo Xsistor Opto-Isol.		.69
MOC3010	Optically Isol.Triac Driver		1.25

SOCKETS

RECEPTACLES

Test TEXTOOL Sockets

ZERO INSERTION FORCE

- Nickel Boron Plating
- G.F. PSF Plastic Body
- For tasting IC's

Part No.	Pins	Price
214-3339	14 pin	5.95
216-3340	16 pin	6.49
218-3341	18 pin	7.95
220-3342	20 pin	8.95

- Nickel Boron Plating
- G.F. PSF Plastic Body
- Wire Wrap Contacts

Part No.	Pins	Price
214-3592	14 pin	9.75
216-3593	16 pin	9.95
218-3594	18 pin	10.95
220-3595	20 pin	11.95

Part No.	Pins	Price
222-3596	22 pin	12.95
224-3597	24 pin	12.75
228-3598	28 pin	13.95
240-3599	40 pin	15.95

LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
24 pin LP	.37	.36	.35
28 pin LP	.38	.37	.35
36 pin LP	.45	.44	.43
40 pin LP	.60	.59	.58
	.63	.62	.61

SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100
14 pin ST	.27	.26	.24
16 pin ST	.30	.27	.26
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.39	1.26	1.15
40 pin ST	1.59	1.45	1.30

SOLDERTAIL (GOLD) STANDARD

	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.26
40 pin SG	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.80	.64	.49
14 pin WW	.69	.63	.56
16 pin WW	.79	.73	.67
18 pin WW	.85	.77	.70
24 pin WW	.99	.90	.81
28 pin WW	1.19	1.08	.99
32 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.26	1.14
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ASST. 6	5ea.	150K 390K	180K 470K	220K 560K	270K 680K	330K 820K	50pcs.	$1.95
ASST. 7	5ea.	1M 2.7M	1.2M 3.3M	1.5M 3.9M	1.8M 4.7M	2.2M 5.6M	50pcs.	$1.95
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7106EV/KIT*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	16.95
7107EV/KIT*	IC, Circuit Board, Display	29.95
7136CPL	3½ Digit A/D LCD Dis. HLD.	18.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7205IPG	CMOS LED Stopwatch/Timer	12.95
7208EV/KIT*	Stopwatch Chip, XTL	19.95
7206CJPE	Tone Generator	5.15
7206CEV/KIT*	Tone Generator Chip, XTL	12.95
7207AIPD	Oscillator Controller	6.99
7207AEV/KIT*	Freq. Counter Chip, XTL	13.95
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	3.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7216EV/KIT*	4 Func. Stopwatch Chip, XTL	19.95
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7216CIJI	8-Digit Freq. Counter C.A.	26.95
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7217IJI	8-Digit LED Up/Down Counter	21.95
7218CIJI	8-Digit Univ. LED Drive	10.95
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7226AEV/KIT*	5 Function Counter Chip, XTL	24.95
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7250IJE	CMOS BCD Prog. Timer/Counter	6.00
7260IJE	CMOS BCD Prog. Timer/Counter	5.25
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74C

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74C30	.39	74C161	1.69	74C911	10.95
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100 pf	.08	.06	.05	.022µF	.09	.07	.06
220 pf	.08	.06	.05	.047µF	.09	.07	.06
470 pf	.08	.06	.05	.1µF	.15	.12	.10

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.22/35V	.39	.34	.29	3.3/35V	.61	.54	.45
.33/35V	.39	.34	.29	4.7/35V	.63	.56	.45
.47/35V	.39	.34	.29	6.8/35V	.79	.69	.56
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2.2/50V	.17	.15	.11	1.0/16V	.15	.13	.12
4.7/25V	.18	.15	.11	1.0/50V	.16	.14	.12
10/25V	.18	.15	.12	1.0/50V	.17	.14	.12
10/50V	.19	.16	.12	4.7/16V	.16	.13	.12
22/25V	.19	.16	.12	4.7/50V	.17	.14	.12
22/50V	.24	.20	.18	4.7/50V	.17	.15	.14
47/25V	.25	.21	.19	10/16V	.15	.13	.12
47/50V	.28	.24	.21	10/25V	.16	.14	.12
100/25V	.28	.24	.22	10/50V	.17	.15	.14
100/50V	.41	.37	.34	47/6V	.25	.21	.19
220/25V	.49	.45	.41	100/16V	.25	.21	.19
220/50V	.49	.45	.41	100/25V	.25	.23	.21
470/25V	.64	.49	.45	220/10V	.25	.23	.21
1000/16V	.49	.45	.41	220/16V	.25	.23	.21

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ALASKA	14	7A	7	7	7	7	7	7	14	14	14A	21
ARGENTINA	14A	14	7	7	7	7	14	21	21A	21A	21A	21
AUSTRALIA	21	7A	7B	7B	7B	7B	7B	7B	7B	7B	14	21
CANAL ZONE	14A	14	7	7	7	7	7A	14	21	21A	21A	21
ENGLAND	7A	7	7	7	7	7A	14	21	21A	21A	14	14
HAWAII	21	14	7	7	7	7	7B	14	21	21	21	21A
INDIA	7	7	7B	7B	7B	7B	7A	14A	14	14	14	7A
JAPAN	14A	14	7A	7B	7B	7	7	7B	7B	7B	14	21
MEXICO	14	14	7	7	7	7	7	14	14A	21A	21A	14A
PHILIPPINES	21	14	7B	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	7A	7	7	7	7	7	14	14A	21A	21A	21	14
SOUTH AFRICA	14	7	7	7B	7B	7A	14	21	21A	21A	21A	14
U. S. S. R.	7	7	7	7	7B	7B	7B	14	21A	14	14	7
WEST COAST	21	14	7	7	7	7	7	14	21	21A	21A	21

CENTRAL UNITED STATES TO:

ALASKA	14	14	7	7	7	7	7	14	14	14	14A	21
ARGENTINA	21	14A	14	7	7	7	14	14A	21	21A	21A	21A
AUSTRALIA	21	14	7B	7B	7B	7B	7B	7B	14	14	14A	21
CANAL ZONE	21	14	7	7	7	7	7A	14	21	21A	21A	21A
ENGLAND	7A	7	7	7	7	7	7A	14	21A	21	14	14
HAWAII	21A	14	7	7	7	7	7	7	14	21	21	21A
INDIA	14	14	7B	7B	7B	7B	7B	14	14	14	14	14
JAPAN	14A	14	7A	7B	7B	7	7	7	7B	7B	14	21A
MEXICO	14	14	7	7	7	7	7	14	14A	21	21A	21
PHILIPPINES	21	14	7B	7B	7B	7B	7B	7	14	14	14	14
PUERTO RICO	14A	7	7	7	7	7	7A	14	21	21A	21A	21
SOUTH AFRICA	14	7	7B	7B	7B	7B	14	21	21A	21A	21	14
U. S. S. R.	7	7	7	7	7B	7B	7B	14	21A	14	14	7B

WESTERN UNITED STATES TO:

ALASKA	14A	14	14	7	7	7	7	7	7A	14	14A	21
ARGENTINA	21	14	14	7	7	7	7	14	21	21A	21A	21A
AUSTRALIA	21A	21	14	14	7A	7	7	7	7	7B	14	21A
CANAL ZONE	21	14	7	7	7	7	7	14	21	21A	21A	21A
ENGLAND	7B	7	7	7	7	7	7B	14	21A	21	14	14
HAWAII	21A	21	14	7A	7	7	7	7A	14	21	21A	21A
INDIA	14	14	14B	7B	7B	7B	7B	7B	14	14	14	14
JAPAN	21A	14A	14	7	7	7	7	7	7	7	14	21A
MEXICO	21	14	7A	7	7	7	7	7A	14	21	21A	21A
PHILIPPINES	21A	14A	14	7B	7B	7B	7B	7	14	14	14	21
PUERTO RICO	21	7	7	7	7	7	7	14	21	21A	21A	21
SOUTH AFRICA	14	7B	7B	7B	7B	7B	7B	14	21	21A	21A	14
U. S. S. R.	7	7	7	7	7B	7B	7B	14	21A	14	14	7B
EAST COAST	21	14	7	7	7	7	7	14	21	21A	21A	21

First letter = day waves Second = night waves
A = Next higher frequency may also be useful
B = Difficult circuit this period F = Fair
G = Good P = Poor * = Chance of solar flares

SEPTEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G/G	2 G/F	3 G/G	4 G/G	5 G/G
6 G/G	7 G/F	8 G/G	9 G/G	10 G/G	11 G/G	12 G/G
13 G/G	14 G/G *	15 F/P	16 G/F	17 G/F	18 G/F	19 G/F
20 F/F	21 G/G	22 G/G *	23 F/P *	24 F/F *	25 F/P *	26 P/P
27 F/F	28 G/G	29 G/G	30 G/G			

By Popular Demand . . .

Yaesu's All-New VHF/UHF Transceivers!

Yaesu is proud to introduce a new generation of computerized VHF and UHF equipment. With the features you have asked for and the quality you demand, these revolutionary transceivers are your passport to the newest frontiers in Amateur Radio!

COMPLETE OSCAR STATION!

- **FT-480R - 143.5 to 148.5 MHz SSB/CW/FM**
- **FT-780R - 430-440 MHz SSB/CW/FM**
- **SC-1 Station Console w/Digital Clock**

A complete microprocessor-based communication system with convenient switching of scanning and microphone controls, AC power supply, and 16 button tone pad.

FT-290R 2M MULTIMODE PORTABLE!

- **Battery Powered (NiCd C-Cells Optional)**
- **LCD Display with Night Light**
- **USB/LSB/CW/FM with 2.5W RF Output**

An entirely new concept in VHF operating! LCD display with full microprocessor control, 10 memories, two VFO's and multimode flexibility, all from a battery powered package. Telescoping antenna built in. Optional FL-2010 PA and FP-80A AC Supply.

FT-208R

2 METER FM HAND-HELD!

- **LCD Display with Lithium Backup Cell**
- **Selectable 5 kHz/10 kHz Scanning**
- **10 Memories with Auto/Resume Scan**
- **16 Button Tone Encoder**

Yaesu's latest thoroughbred for 2 FM is the FT-208R Hand-Held. Four digit LCD display, 10 memories, limited band scan, and priority channel make this the most versatile hand-held ever made available to the amateur fraternity.

FT-690R

6M MULTIMODE PORTABLE!

- **USB/CW/AM/FM Battery Portable**
- **LCD Frequency Display with Night Light**
- **10 Memories with Lithium Backup Cell**

Catch those exciting DX openings with the new FT-690R 6 meter portable. Repeater shift (1 MHz), two scanning steps per mode, and dual VFO's for top flexibility.

FT-708R

70 CM FM HAND-HELD!

- **LCD Display with Lithium Backup Cell**
- **Selectable 25 kHz/50 kHz Scanning Steps**
- **440-450 MHz with 10 Memories**
- **Memory/Band Scan and Limited Band Scan**
- **Resume Scan**
- **16 Button Tone Encoder**

Yaesu leads the way with its pioneering microprocessor controlled 440 MHz hand-held. Priced competitively against much simpler units, the FT-708R system includes a full line of accessories, including CTCSS, NiCd chargers, and remote speaker/microphone options.

Sporting unmatched engineering and manufacturing know-how, Yaesu's technical staff is committed to pushing the state of the art. Yaesu products are backed by a nationwide dealer network and two factory service centers for your long-term service needs. So when it's time to upgrade your station equipment, join the thousands of hams that are tired of compromise – join them by investing in Yaesu!

Some accessories pictured above are extra-cost options. See your Yaesu dealer.

Prices And Specifications Subject To Change Without Notice Or Obligation

YAESU

The radio.

881

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Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45246 • (513) 874-3100

Dyna-"mite."

Miniaturized, 5 memories, memory/band scan

TR-7730

The TR-7730 is an incredibly compact, reasonably priced, 25-watt, 2-meter FM mobile transceiver with five memories, memory scan, automatic band scan, UP/DOWN manual scan from the microphone, and other convenient operating features.

TR-7730 FEATURES:

- **Smallest ever Kenwood mobile**
  Measures only 5-3/4 inches wide, 2 inches high, and 7-3/4 inches deep, and weighs only 3.3 pounds. Mounts even in the smallest subcompact car, and is an ideal combination with the equally compact TR-8400 synthesized 70-cm FM mobile transceiver.
- **25 watts RF output power**
  Even though the TR-7730 is so compact, it still produces 25 watts output for reliable mobile communications. HI/LOW power switch selects 25-W or 5-W output.
- **Five memories**
  May be operated in simplex mode or repeater mode with the transmit frequency offset ±600 kHz. The fifth memory stores both receive and transmit frequency independently, to allow operation on repeaters with nonstandard splits. Memory backup terminal on rear panel.
- **Memory scan**
  Automatically locks on busy memory channel and resumes when signal disappears or when SCAN switch is pushed. Scan HOLD or microphone PTT switch cancels scan.
- **Extended frequency coverage**
  Covers 143.900-148.995 MHz in switchable 5-kHz or 10-kHz steps, allowing simplex and repeater operation on some MARS and CAP frequencies.
- **Automatic band scan**
  Scans entire band in 5-kHz or 10-kHz steps and locks on busy channel. Scan resumes when signal disappears or when SCAN switch is pushed. Scan HOLD or microphone PTT switch cancels scan.
- **UP/DOWN manual scan**
  With UP/DOWN microphone provided, manually scans entire band in 5-kHz or 10-kHz steps.
- **Offset switch**
  Allows VFO and four of five memory frequencies to be offset ±600 kHz for repeater access (or to be operated simplex) during transmit mode.
- **Four-digit LED frequency display**
  Indicates receive and transmit frequency during simplex or repeater-offset operation.
- **S/RF bar meter and LED indicators**
  Bar meter of multicolor LEDs shows relative receive and transmit signal levels. Other LEDs indicate BUSY, ON AIR, and REPEATER offset.
- **Tone switch**
  Activates internal subaudible tone encoder (not Kenwood-supplied).

Optional accessories:

- **MC-46** 16-button autopatch (DTMF) UP/DOWN microphone
- **SP-40** compact mobile speaker
- **KPS-7** fixed-station power supply

More information on the TR-7730 and TR-8400 is available from all authorized dealers of Trio-Kenwood Communications, Inc., 1111 West Walnut Street, Compton, California 90220.

KENWOOD
...pacesetter in amateur radio

Synthesized 70-cm FM mobile rig

TR-8400

- **Synthesized coverage of 440-450 MHz**
  Covers upper 10 MHz of 70-cm band in 25-kHz steps, with two VFOs.
- **Offset switch**
  For ±5 MHz transmit offset on both VFOs and four of five memories, as well as simplex operation. Fifth memory allows any other offset by memorizing receive and transmit frequencies independently.
- **DTMF autopatch terminal**
  On rear panel, for connecting DTMF (dual-tone multifrequency) touch pad (for accessing autopatches) or other tone-signaling device.
- **HI/LOW RF output power switch**
  Selects 10 watts or 1 watt output.
- **Virtually same size as TR-7730**
  Perfect companion for TR-7730 in a compact mobile arrangement.
- **Other features similar to TR-7730**
  Five memories, memory scan, automatic band scan (in 25-kHz steps), UP/DOWN manual scan, four-digit LED receive frequency display (also shows transmit frequency in memory 5), S/RF bar meter and LED indicators, tone switch, and same optional accessories.

Specifications and prices are subject to change without notice or obligation.